THE

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"ELECTRICAL REVIEW."

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THE

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THE ELECTRICAL FIRE BOGEY.

DESPITE the many occasions on which this cry has been raised by the gas fraternity, and the searching exposures which have been given of the sort of evidence usually characterising the stories, our contemporary the *Journal of Gas Lighting* returns to the charge in quite the old manner, in its issue of November 10th, through the mouth of its Scotch correspondent, who works himself into a very excited state on the dangers of electricity in particular, and the wickedness of municipalities in general. On the latter point we have nothing to say, merely remembering *en passant* that gas manufacture is largely in the hands of companies. With the former matter, also, we should be content to be amused and pass on to the order of the day, were it not that such statements as the one in question often reach ignorant ears and accomplish just that mischief for which the wish is father to the thought. Again, there is always the feeling when dealing with such unscrupulous opponents as the gas fraternity have shown themselves to be, of falling between the Scylla of "silence gives consent" and the Charybdis of "*qui s'excuse s'accuse;*" under all the circumstances we think it best to take up the cudgels for electricity, and whenever possible, as in the present case, to carry the war into the enemy's camp, by exposing the hollowness of the foundations on which such stories are built up, and showing the true cause of many mysterious fires.

Let us examine first the statement of this worthy Scotch gentleman. This is how he begins:—

> Two things have happened in Scotland this week, from which, when read together, may be derived a most cogent warning regarding a danger which may be found in some phases of municipal activity. Last night a fire broke out in a range of gigantic warehouses in Buchanan Street, Glasgow, and in the space of three hours damage was done to the amount of, it is estimated, £120,000.

The other thing, by the way, occurred at Falkirk, and was a successful action against the Corporation for negligence, whereby plaintiff's works were flooded. Plaintiff obtained a verdict for £3,000, and whilst this matter does not concern us, it is taken by the Scotch correspondent as a peg whereon to hang municipalism, and so bolster up his argument in the fire case. Now let us see how he proceeds. Having fired off his big gun of £120,000 damage "in the space of three hours," he continues:—

> The Glasgow catastrophe was the result, it is believed, of the fusing of an electric wire. I find that in all the accounts I have been able to see of the matter, the origin of the fire is never alluded to, except in one newspaper, in which the electric wire theory is given.

At last, the cat is out of the bag. "It is believed" is almost as good evidence as the fact that of all the Glasgow papers only one was righteous; and that one, it appears, only gave an electric wire *theory*. It may be objected that all this is mere innuendo; so it is, but therein lies the mischief. Statements of fact can be inquired into; dark hints, even with the weight of evidence against them, leave the

C

impression in the minds of the ignorant that "there must be something in it, you know." However, our Scotch gas friend proceeds first of all to draw a red herring across the path of his suggestions by pointing out the dire mystery attached to what he has noticed—namely (tremble, ye Fire Brigade Superintendents), the disappearance in recent years from reports of fires, of the statement of their origin. Here are all the elements of a deeply laid conspiracy. But now he returns to the charge—the electrical one—and taking as a fact what he previously threw out as a mere suggestion, he proceeds with his case as follows :—

I suppose it will be easy to admit that it would be unpalatable to those who supply current to have it announced that such a dire disaster as this in Glasgow was the outcome of a defect in the electric light arrangements. This observation has all the more force when the supply of electricity is in the hands of the Corporation. Fire Brigades are Corporation servants; and it would be, to say the least of it, unsavoury conduct on the part of one department to do anything which might check the growth of another. I assert that, whether it be of intention, or whether it be on account of the greater subtlety of fire causes, we are not so fully informed upon the subject of origin as we used to be; and when, as in the case of this Glasgow fire, we find that, deriving their information from a common source, only one newspaper ventures to give the reason which was authoritatively furnished to them, it is proved that there is a desire to put out of view what might not be appreciated by the Electric Light Committee. The decision in the Falkirk case comes in with great pertinence here. If the Corporation of that borough are held liable for loss arising through an extraordinary strain being put upon a sewer, it is not a far cry to the holding of the Corporation of Glasgow liable for loss arising through a defective electric light fitting. The deficit in the working of the Glasgow Corporation Electricity Department last year was over £13,000. If fire claims come to be made a charge upon the department, when may the day arrive when deficits will be unknown? We may say, "Never." In writing this, I fully realise that the extent of the risk, which may not be new, but which is certainly emphasised by the Falkirk decision, will depend greatly upon the extent of the service which the Corporation provide. Liability will only go as far as the Corporation themselves go. If they stop short when they reach the boundary of the customer's premises, they will not be responsible for anything which may happen inside. But if the Corporation, by themselves or by arrangement with companies or contractors, extend their control over the wiring of interiors, they cannot escape the consequences of defect in such work. It is here that the warning note must be raised. The Corporation of Glasgow do not wire premises; but they supply "lamps and fittings" in connection with a change of voltage, and they have power to hire out motors and accessories. In all of this there is room for much liability, according to the terms of the agreements with the customers.

We apologise for quoting at such length, but it is only to show the mischievousness of the whole line of argument. Firstly, the fire is an electric one on no tittle of evidence; secondly, the mystery of omission of origin of fires from reports; thirdly, collusion between two municipal services to suppress the truth; fourthly, the Falkirk peg to frighten canny Glaswegian ratepayers at the liabilities they may incur through electrical supply. Very clever and also ingenious—not to say ingenuous as well—for when the matter is examined, the whole argument falls to the ground like a pack of cards.

If the Scotch correspondent had taken the trouble to inquire into the matter, his weekly letter would have been a great deal shorter. In the first place, there is no support for the statement that, ". . . . deriving their information from a common source, only one newspaper ventures to give the reason which was authoritatively furnished to them. . . ." Who furnished the reason authoritatively? A few sentences before, it was "the electric wire *theory*" which only one paper gave. Now, the statement in question was made by a Glasgow halfpenny paper, and it was based simply on the idle word of an employé of the firm in whose premises the fire started; he seems to have stated that he did not know in the least what could have been the cause of the fire, unless it was that one of the electric wires had fused somewhere! There is a a great distinction between probability and actuality.

We understand, also, that the officers of the Fire Brigade see absolutely no reason whatever to attribute the cause of the fire to electricity. Of course our Gas contemporary will see here evidence of *suppressio veri*, and it will rejoice to hear that there was actually evidence of a short-circuit on the feeder in question, after 10 o'clock. But let us rudely dash these false hopes to the ground; *the fire broke out more than an hour previously*, and was the cause and not the effect of the short-circuit. What is more, there was no one in the building at the time of the outbreak, or after, who could give any reason for the cause of the fire, which might have been due to the heating apparatus, or to some carelessness on the part of those last there. Thus falls to the ground the whole argument and elaborate theory of our gassy friend, who is, of course, quite oblivious of the fact that more fires are caused every week by gas explosions than are even attributed to electrical agencies all the year round.

If we take the trouble to inquire further into the causes of mysterious fires (not mentioned in reports!), we think that the electrical faculty can give the gas interests some information; and let us at once premise this by stating that the supply authority can hardly be held responsible for what occurs on consumers' premises when they supply new lamps and fittings, unless in the process of conversion the supply authorities cause wiring or fittings to be altered, and that negligently. It is frequently the case that the gas fitter has come into premises after the wiring contractor, and has deliberately mixed his compo tubes up with the steel tubing containing the wires. What is the result if there does not happen to be a good "earth" on the section of steel tubing touched, and the insulation within has been slightly damaged, or even put under mechanical strain? A small hole is burnt into the compo tube, from which the gas immediately issues and is ignited. The flame then melts the compo, and commences to travel back along the route of the pipe, which is generally between joists or behind a match lining. Whilst such accidents do not in any way excuse the wireman for careless work, they condemn the system of running gas in compo tubes without in any way troubling to find out the risk incurred by ignoring the presence of electric wires. Such accidents are known to electrical engineers to be of frequent occurrence; and if any blame can be attached to the wiremen, they are honest enough not to cry out that it was gas that did it, albeit had the gas not been there the electric wires in themselves would not have caused the accidents. It is, perhaps, sufficient to warn all those having electric light in their houses to insist on having compo gas pipes removed if in close proximity to the wires; and if new pipes have to be run, that these should be of iron barrel. Perhaps it is useless to expect architects, who live in a world of their own (except when electrical fittings have to be bought), to take any heed of this danger from gas; but we hope the insurance companies will take note of what has been common knowledge for some time. It is for them, whilst rightly taking every precaution to see that electric wiring is properly carried out, to observe also that the consumer's premises are properly protected from fires caused by gas in the manner indicated. Before our Gas contemporary discovers another marc's nest, we think it could, with advantage, take steps to remove all causes of suspicion from the methods employed by its own people. One thing is certain; the competition of electric light will not be stopped, or even hurt, by such stories as we have exposed.

A Modern Autocrat.

We have before us a copy of a specification recently issued by the resident electrical engineer to the Hornsey Urban District Council. We should be sorry to think that it illustrated the working of the biological principle of "Reversion to Type," for we hope that the original business instinct of the race had, at any rate, a larger element of justice in it than the actual phrasing of the document before us leads us to suppose that it possesses to-day. When so many efforts have been made to standardise in the electrical industry a few at least of the principles of fairness, it is disheartening to find such demands as the following :—

The engineer to be sole judge in case of dispute.

The engineer to have full power to terminate contract at any time on giving seven days' notice, if the work is not to his satisfaction.

The engineer to have power to delay or refuse payment without appeal, if in his opinion the goods are not satisfactory.

These stipulations are in direct conflict with the letter and spirit of the proposals of the Institution of Electrical Engineers, as well as the practice of the most trusted members of the profession. We have repeatedly pointed

out the injustice as well as the absurdity of one of the parties to a dispute acting as the sole arbiter, and we hope that the day is not far distant when such a proposal will be held to be beneath the dignity of any member of the profession.

It is, however, not the general conditions alone that we have to condemn. The subject matter needs much revision before its meaning can be fully understood. It is true that the compiler had a fear of such a result in his mind, for in one of the clauses of the general conditions he offers an appointment, if deemed desirable, to clear up any obscure point. The specification is for the supply of meters, demand indicators, and fuse boxes. The wording of the section relating to meters is fairly clear, but the alteration of a few words hardly renders it a model specification for demand indicators, especially when many of the sentences specifically refer to meters which are not demand indicators at all.

The latter part of the specification deals with fuse boxes, and is accompanied by a litho. It is unfortunate that many of the points preferred in the specification are contradicted in the drawing; thus, in the specification, the case in one piece, and "closed chamber" fuses, are asked for, while the drawing goes rather out of its way to show a sealing chamber bolted to the fuse box and an open-type copper wire fuse.

Then again, the engineer claims the right of varying to an unlimited amount the value of the order with regard to meters and demand indicators, without giving the contractor the opportunity of revising his price. He also, though this is a small matter, specifies in detail and issues a drawing showing his requirements, and then proposes to make the contractor responsible both for possible patent infringements and also for non-compliance with Board of Trade requirements.

It would not be difficult to point out other peculiarities, but why proceed? We live to learn; perhaps in the future the compiler of this specification may come into line with his fellow engineers, and by precept and example endeavour to guard the profession from the possibility of any imputation of unfair or unjust dealing.

The Heating Effect of Radium.

THE discovery by Curie and Laborde that a gramme of radium gives out continuously 100 gramme calories of heat per hour, revealed one of the most remarkable properties of this wonderful metal, and has given rise to much speculation as to the source of this large output of energy. The idea till quite recently was, that the heat was due to the conversion of the kinetic energy of the particles thrown off by the disintegrating atom of energy, but some experiments made by Rutherford have led Schuster to the conclusion that this view is erroneous. The radium atom, as is now well known, in breaking up throws off positive and negative electrons, and leaves a residue of the original atom, which forms the atomic basis of a gaseous "emanation" which, in turn, breaks up into a new material known as "excited activity," so called from the phenomenon to which it gives rise. This "excited activity" has been supposed by Rutherford to represent three stages of disintegration, and the radiation from the final form (possibly helium) consists almost entirely of the minute negative electrons or corpuscles. What Schuster has demonstrated (see *Nature*, November 19th, 1903) is, that it is the radiation from this final residue left from the disintegration of the radium atom, which gives rise to the greater part, if not the whole, of the continuous heating effect of radium. The higher velocity of the negative electrons evidently more than compensates for their deficiency of mass. The process appears to be analogous to a bullet fired from a gun; the bullet, though smaller in mass, is much more striking in its external effects on account of its higher velocity.

Continuous Rails.

THAT mechanically-joined tramway rails are doomed is a conclusion long since reached by the engineer who is abreast of the times, but there are few indications, at present, that the time is at hand when fish-plates and bolts, and the myriad patented sole-plates and joints, will be less common than the welded continuous rail. We believe that engineers and managers are alive, as a rule, to the extreme desirability of a sound welded joint, but they have been chary, and rightly so, of recommending any system on which Time has not played his most destructive part. Tales from America of the cast and the electric weld have been none too reliable, and nowhere else has experience with either been extensive or prolonged. Moreover, it would seem that the cost of the plant for either system is too large either for purchase or hire by any but the largest companies. Indeed, the whole rolling stock of many British undertakings does not involve the capital outlay required for an electric welding plant.

Everyone has been attracted by the idea of the Goldschmidt alumino-thermic weld since its publication, and all but everyone has been waiting for some demonstration of its practical value. What experience there is up to date—and some of it dates back four years—seems to be very much in favour of this simple joint, and Leeds, Glasgow, Nottingham and other towns, are introducing it to the British tramway world.

The nature and application of thermit should be well known to our readers, but for a clear, well-written and illustrated treatment of the whole range of the thermit process, we commend the article on Alumino-thermics by the originator of the process in the current number of *Electro-chemical Industry*. There it is shown that although finding a special field of usefulness in rail-welding, the thermit process may be adopted wherever metallic fractures have occurred, or where two metallic surfaces are to be intimately joined. Instances are given where repairs usually involving enormous expense, such as making good the broken stern post of a large screw steamer, or welding a broken crank-shaft or tail-shaft *in place*, have been executed at a mere fraction of the normal cost.

It is in the manufacture of iron and steel that the most interesting example of the value of thermit re-action is to be seen. By the introduction to the body of molten metal in a foundry crucible of special thermit alloys, new constituents, such as titanium, manganese, nickel, &c., may be added with the certainty of perfect distribution, and the same "box" method of causing an intensely concentrated heat reaction is being used with much success to reduce the loss hitherto brought about by the large cavities in the heads of steel ingots.

In the field of metallurgy, many other benefits have been derived from the use of thermit alloys. It is stated that welding rail-ends with thermit is performed more quickly than when making a mechanical and electrical joint with fish-plates and bonds, but the comparative cost is not given. The solid "joint" will need to be much more expensive than the mechanical joint before it becomes really dearer, and we recommend those many unfortunates whose rail joints are dropping to see what they can do with thermit.

The Edison Cell.

ELSEWHERE in this issue we reproduce part of Mr. Hibbert's paper on the Edison storage cell for automobiles, describing the results of his protracted observations and experiments, which was read before the Institution of Electrical Engineers last night. We hardly need say that Mr. Hibbert's expert knowledge of accumulators, and his independent position, lend to his opinions an authority which cannot be gainsaid, and, therefore, the fact that he has no fault to find with the performance of the cell, either on the road or on the bench, must be regarded as of the greatest significance. Evidently the Edison cell is destined to occupy a prominent place in the electrical industry, and as we are credibly informed that by a trifling change in its construction a very considerable improvement in its output has been effected, we may look for even better results in the future than those described by Mr. Hibbert. The development of electric automobilism is a matter of the first importance to the industry, and every advance towards this object ought to be heartily welcomed.

THE DESIGN OF DIRECT-CURRENT MACHINERY.

By VAL. A. FYNN.

(*Continued from page* 809.)

The writer advocates the choice of steel for the poles in order to get the shortest possible mean length of turn for the field coils, and for the same reason the round pole is preferable. The use of laminations, however, precludes this shape, so we must do the next best thing, and make the body as nearly square as possible.

The use of a steel pole with a steel frame presents no difficulty, but when used in conjunction with a cast-iron frame or yoke introduces a complication. At the point of transition from steel to iron, the latter will, under normal conditions of design which allow for a density in the pole body at that particular point of some 16,000 to 17,000 lines per cm^2, become absolutely saturated, introducing a very appreciable and useless resistance into the magnetic circuit. This condition will find expression either in an increased weight of field copper, or, provided the field coil cooling surface is sufficient, in a decreased efficiency.

Whenever no special constructive means are taken to remedy this defect, it will be least apparent when the construction (fig. 5) is adopted; the seating for the pole being circular, presents the greatest possible surface under the circumstances, and the choice of a bolt of an abnormally large diameter will further help in the same direction.

It is easy to tool this seating, and it obviates the necessity of a steady pin. When a steel frame is used, fig. 5 again shows the most suitable construction.

The next step is shown in fig. 6. This gets over the choking effect at the transition section, but introduces still more tooling, since the pole-shoe is made removable in order to get the coil into position. Here this pole-shoe can be

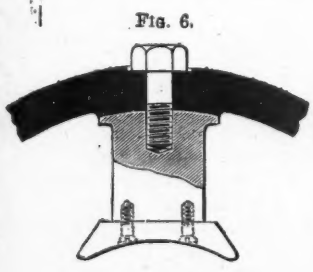


Fig. 6.

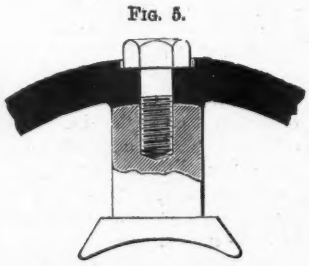


Fig. 5.

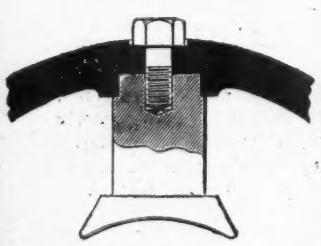


Fig. 8.

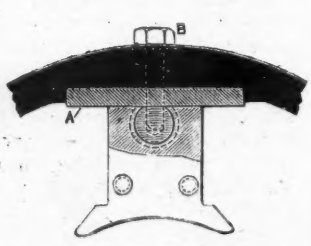


Fig. 7.

made laminated; but even the neatest construction for such shoes entails a good deal of tooling, and electrically falls short of the totally laminated pole.

A further method is given in fig. 7, which also shows a good type of laminated pole. This construction can be applied equally well to a solid pole, and shows what is theoretically the best solution; as far as amount of tooling is required, even when the disc is not recessed, it stands a little behind fig. 6. The seat for the steel disc A is tooled at the time when the frame is on the boring bar and having the holes drilled for the bolts B. Fig. 8 is a possible simplification of the previous case when solid poles are used.

Should it become necessary to provide means against excessive cross magnetisation, there are only two ways open which yield results in proportion with the increased cost they necessitate. The one is complete magnetic separation of pole body and frame, fig. 9, and the other is the provision of a series winding enclosing the armature, and embedded in slots placed close to the air-gap in the pole-shoe.

As we shall see later, such measures can only be of use in the small machines we are dealing with in special cases, as,

Fig. 9.

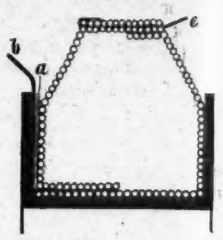


Fig. 10.

for instance, when an exceedingly wide variation of speed is required, and is to be obtained by regulation in the field only.

For the mechanical construction of the exciting coils, the writer strongly advocates the use of ready-made formers moulded of non-hygroscopic material and stiffened with metal insertions, and would remind designers of the importance of proper end connections.

Fig. 10 shows a style which has been found to give perfect immunity from breakdowns, *a* being a thin wooden or fibre disc with a radial slot in it, allowing the well insulated end, *b*, to be brought out and keeping it free from the pressure of the other convolutions. Both ends are soldered round two or three turns and consist of well insulated copper strips. The top end, *c*, is carried away under the top layer so that any pull exerted shall not come directly on to the turns to which it is soldered.

When rectangular spools are used it is of great importance to see that the sides are made strongly convex (fig. 11), as it is quite impossible to make the copper wire lie closely to a straight surface of any length. Vibration causes these loose wires to damage their own insulation and a breakdown results.

Efficient insulation between shunt and main is often a difficult matter. The arrangement shown in figs. 11 and 12, and devised by the author, has given absolute satisfaction. The little brass supports shown in detail in fig. 12 are held in place by means of binding wires at *a*.

The greater part of the insulation is air, and both coils are very well cooled. The main coil is wound on a former and forced on to the small brass supports, being insulated

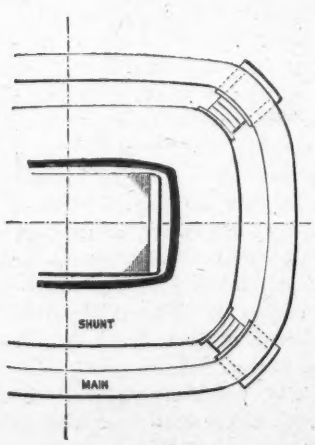


Fig. 11.

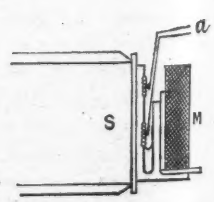


Fig. 12.

from these by micanite, whilst the supports themselves are again insulated from the shunt coil by the same material.

The writer thinks that terminals should always be used, and in his opinion their correct position, in the case of motors, is inside the frame, well out of the way of possible accumulations of oil or water, and out of reach of accidental contact or interference. Short cables should be taken from these terminals to the outside through glands, and the mains soldered to these. Armature and field windings should not

be interconnected inside the machine, but their respective ends brought out separately.

The modern bearing leaves little room for improvement, and the spherically-supported bush with ring lubrication could only be bettered by the introduction of a concentrically-adjustable ball bearing. The friction losses, which are quite an important item in small machines, would be very materially reduced, and the necessary attendance still further minimised, whilst a saving in space would be effected. There is no reason whatever why the cost of such bearings should be prohibitive when they are once taken up by specialists and made in quantities.

Turning our attention to the shafts, the author still keeps coming across very poor designs. He has found many illustrations of Mr. Fischer-Hinnen's contention that the portion of a dynamo shaft which is subject to the heaviest strain is that in the neighbourhood of the commutator. The empirical formula reproduced below, which has found such favour on the Continent, actually gives very reliable results for ordinary sizes, provided the so-called constant is judiciously varied. The values for c, which have been found suitable for the sizes under discussion, vary from 10 for the smallest to 7·5 for the largest.

$$\text{Diameter in inches} = c \sqrt[3]{\frac{\text{H.P. (normal)}}{\text{revs. per min.}}}.$$

In settling these values for c we have borne in mind that the machines under discussion, when used for crane work, with suitably altered windings, are asked to exert a torque fully 2 to 2½ times the normal.

Having settled the diameter of shaft through the commutator, we make it at least equal to this through the armature, and then step down to the journals at each side, allowing for the necessary shoulders; in this way a shaft diameter through pulley end bush is arrived at, equal to about ·80 of the diameter through commutator. The length of the journal can now be settled, figuring to obtain a normal value for the pressure per square inch with due allowance for the generally high speeds and possible increased pull due to eccentricity. As a guide, we may say that the journal diameters obtained on these lines generally necessitate a length at the pulley end from 2¼ to 2½ times the diameter.

When the armature laminations are mounted directly on the shaft, it is necessary to allow for a key surface fully 50 per cent. in excess of ordinary conditions. The surface against which these keys drive is composed of a series of extremely sharp edges which, if the pressure is at all excessive, very soon cut the key very badly. The play thus obtained enables them to score the shaft as well, and very soon the core becomes so loose as to necessitate rebuilding or the insertion of a new shaft.

The commutator still affords the most difficult mechanical problem in dynamo construction, and the imperfections of that important part are responsible for a great proportion of the trouble experienced. The insulation should, of course, be made up of mica and micanite only, and especially where high voltages are concerned, the length of path over the insulation, from current-carrying parts to frame, should be ample.

The commutators should be built on sleeves, and these ought not only to be positively driven by means of a key, but also prevented from moving lengthways along the shaft; disregard of these rules leads to broken wires. If there is the slightest chance of the commutator getting very hot, lugs should be used.

The use of carbon brushes is now general, but their perfect operation depends greatly on absolute relative fixity of the segments; this condition is difficult to satisfy, the more so when the number of sections is great.

A hydraulic press is about the only tool that will compress the segments sufficiently, but it is a costly apparatus, and whilst its acquisition is justifiable for the construction of large machines, it might not pay makers of the smaller motors to go to such expense. Shrinking iron rings round the built-up commutator is objectionable, as it destroys the temper of the copper, and the rings must be cut through to be removed. Driving cold steel rings over the built-up segments requires a hydraulic press.

Commutators have worked loose which have been most carefully put together, but it has always been possible to cure the defect by running these commutators for some five or six hours under exaggerated working conditions. These can be obtained by clamping the commutator between wooden blocks, something after the style of a prony brake, preventing these from rotating and driving the commutator at, say, 50 per cent. higher speed than normal. The pressure of the blocks can be adjusted so as to heat the commutator excessively. The lock nuts are gradually tightened as the whole cools, and the commutator trued up in the lathe after it has been fixed in position on the shaft.

By making a practice of running all commutators under these conditions, less labour could be expended on their building up, and cheap tools would suffice.

The next item to be considered is also one of vital importance to the successful running of these machines. The writer refers to the brush-gear. The extremely great variety of designs already points to the unsettled state of this question. The writer's experience goes to show that the conditions to be fulfilled are somewhat as follows:—

The moving parts should be as light as possible, and it is best for the carbon brush only to move.

The current should be conveyed from the brush to the holder by means of copper strips or cables of ample section, and making perfect contact with both brush and holder. These strips or cables should not interfere with the free motion of the brush, which should be guided loosely in the holder box.

The pressure keeping the brush up to its work should be adjustable, and exerted as nearly as possible along the line of movement of the brush.

The width of the holder (its dimension perpendicular to the axis of the commutator) should be kept down as far as possible, which is equivalent to saying that the holder should be supported as near the brush as possible.

A type of holder designed by the author is shown in fig. 13; it has been used for a number of years with

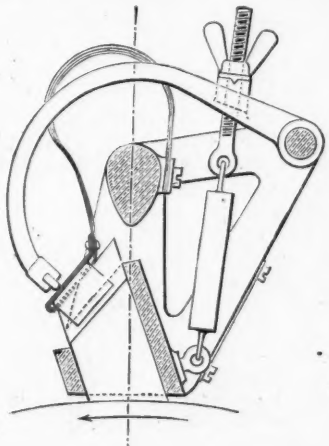


Fig. 13.

absolute success, and embodies all the points mentioned above.

The figure shows the inclined type as used on dynamos or motors which are not required to reverse their direction of rotation. The radial type follows exactly the same lines. A number of short brushes are used side by side in the same holder with only a small clearance between them and a spring lever to each. The commutator should revolve against the inclination of the brush.

The rockers should be of very rigid construction, and should hold the brush-holders in such a way as to preclude all possibility of twisting. The path over insulation from live portions to frame should again be long, as here also conducting dust accumulation is to be feared.

Whilst on the subject of brushes, we might draw attention to the practice of so many consulting engineers to specify very carefully that the brushes should be of such a section as to carry the line current at a density not exceeding 30 amperes per square inch. The writer fails to see the utility of such a clause.

It must be remembered that, according to the nature of

the winding, one or two or more segments under one brush will at some time during the process of commutation transmit to it the whole of the current, derived from the circuit to which they correspond, and provided the process of commutation is satisfactory, this will represent the maximum density in the brush.

It is quite possible, by making the brush short but very wide, to easily fall within the "30-ampere" limit, and yet obtain a very much greater current density in parts.

(To be continued.)

THE TRADE OF SOUTH AFRICA.

A VERY important Blue-Book was issued a few days ago dealing with the above subject. Last January the Board of Trade sent Mr. Henry Birchenough out to study the position of affairs in the old and new colonies, and, spending most of his time in Johannesburg, the Special Commissioner also visited Capetown, the Eastern Province of Cape Colony, Kimberley, Lourenço Marques, and Bloemfontein, &c. Time did not permit of an inspection of Rhodesia, but much information was gained from well-informed Rhodesians. The report now issued consists of two parts, dealing respectively with the trade of South Africa, and with the international competition for that trade. To show the importance of South Africa as a purchaser, Mr. Birchenough says :—

The rapidity with which South Africa has come to the front as a great market for British manufactures is almost startling. Ten years ago, in 1893, Great Britain's exports to South Africa were valued at a little under nine millions; last year they almost reached 26 millions. In 1893, South Africa stood sixth on the list of Great Britain's customers; last year she stood second. She had left America, Germany, France, and Australia behind, and was only beaten by India. It is no rash prediction that this year she will pass India and stand first on the list as the largest buyer in the world of the produce and manufactures of the mother country.

South Africa is already our best customer for mining machinery, cast and wrought-iron, and steel manufactures (neglecting other things outside our province); our second best customer for locomotives and iron and steel wire; and third on the list for angle, bar, and galvanised iron. The development must not be regarded as merely temporary, a reaction after the war. The war, indeed, has been beneficial by raising credit; it weeded out the weak and insolvent firms, strengthening others. The common and natural error of thinking that the gold mining industry of South Africa must be speculative and uncertain because the "Kaffir" stock market is speculative and a gamble, must be carefully avoided. Given a sufficiency of labour, the gold mining financiers hope to be able to spend £50,000,000 in development and equipment during the next 15 years. Fresh mineral discoveries are being reported nearly every month: gold and copper have been found in the Limpopo district; coal near Spelonken; silver, tin, and thorium near Steynsdorp. The railway development which is impending is very large; since the Netherlands Railway was transferred to Colonial control, all the orders have come to us; and soon there will be a great demand for electrical machinery and appliances, lighting and power plants, not only from the railways, but on behalf of municipal authorities and private firms. It is necessary, however, to remember that there is an inflation of prices, and too many of more or less definitely organised "rings." The general impression in South Africa is that the middlemen and distributors are taking too large a profit. It would be better that there should be a lowering of prices (and thus a decrease in the cost of living); for the greater volume of trade which would thereby ensue would compensate for the smaller profit on each transaction. The South African "conference" is very harmful to British trade; for, by the action of this British trust, it costs more than twice as much to ship one ton of goods from Southampton to the Cape as is charged for delivery from New York.

Coming now to the question of foreign competition, Mr. Birchenough states that there are whole branches of trade where Great Britain stands supreme, other trades where we hold our own but encounter increasing specialised competition, and a few branches where we are behind. We are completely beaten by Americans in agricultural implements, and hard hit by them in electrical engineering and steel frame construction. America is our most important rival, but only about one-half of her importations is in competitive articles. The Americans limit their efforts to those branches of trade in which the natural resources of their country, or the similarity of conditions as between South Africa and the States, give them special advantages. German competition is much more general, but far less serious. Belgium and Switzerland, in the second rank, have to be reckoned with; but, says Mr. Birchenough, "there is no branch of engineering work in Johannesburg of which British manufacturers might not obtain an absolutely predominating share if they would lay themselves out to study minutely the special needs of the market, modernise their methods, and display the vigour, enterprise, and adaptability which are shown by the best of their rivals." Some of the special causes of the success of foreign competition are :—

Superiority of some natural resources.
Experience in dealing with similar local conditions.
Greater exercise of ingenuity and inventiveness.
Closer study of local requirements, resulting in the adaptation of goods to special local needs.
Greater alertness and adaptability—less conservatism.
Superiority of some business methods.
Quicker delivery and closer adherence to contract dates.
Adoption of standard types and standardisation of parts.
Better finish and make-up.
More scientific packing.
Dumping in South Africa of surplus goods from protected home markets.
In the case of the engineering trades a better system of representation.
The presence on the mines of American engineers favourably disposed to American machinery.
The practice of German mining groups in giving their orders to German makers.

And, finally, with the object of making most powerful our resistance to foreign competition, Mr. Birchenough lays special stress on the necessity for attention to the annexed suggestions :—

1. A more careful study on the part of British manufacturers of the local conditions and special requirements of the South African market. Nothing will stimulate this so much as the personal visits of principals and directors of British firms.
2. In view of the great and increasing importance of the market, more vigour and enterprise in attacking those branches of trade in which we are weak, and less conservatism in general business methods.
3. Better and more authoritative representation, especially in Johannesburg, where direct representation is absolutely necessary. If firms cannot afford a representative of their own, members of allied trades should combine and employ a man to represent them jointly.
In the engineering trades, representatives should be men of both technical and business training, and should be given as much discretion as possible in quoting prices for large contracts.
4. A more liberal system of credit in Johannesburg involving a frank acceptance of the mines' terms. Business should be financed from the British side and not in Johannesburg.
5. Prompter delivery and a closer adherence to contract dates.
6. Larger stocks of standard types of machinery, of fittings, and of spare parts.
7. Standardisation wherever possible.
8. Greater attention to make-up and finish.
9. More scientific packing in all branches of trade.
10. Further improvements in catalogues and advertising.
11. More information to be given, especially to the engineers and buyers of Colonial Governments and municipalities.
12. More attention to small details of all sorts.
13. The training of British engineers to take a larger share of the most important posts in the mines.
14. Maintenance in British hands of the financial control of as many undertakings as possible.
15. The cheapening of production by the better and more modern organisation and equipment of works and manufactories.
16. Uniformity of British and foreign freights.
17. Through rates and through bills of lading from the place of manufacture to destination.

REVIEWS.

Engineer's Constants for the Slide Rule. By J. A. BURNS. Birmingham: C. Combridge, New Street. 1903. Price 9d. net.

In this little pamphlet, after a brief explanation of the working of the rule, a variety of practical applications are described involving the use of special constants, and it is suggested that the user who frequently requires certain

constants should mark their exact position on his slide rule. These constants can be calculated by each individual for himself, depending upon the particular class of work upon which he is engaged. The pamphlet concludes with a number of tables of weights and measures, including conversion tables, reprinted from the "*Practical Engineer* Pocket-Book." It will be seen that the work is rather suggestive than informative; the idea upon which it is based is so obviously practical and commendable that further comment is unnecessary.

The Slide Rule. By C. N. Pickworth, Wh. Sch. Eighth Edition. Manchester: Emmott & Co., Ltd. 1903. Price 2s.

New editions of this useful manual have become an annual event, and this fact is sufficient to vouch for its excellence. The present issue has been considerably enlarged, and now contains matter relating to the use of log.-log. scales, special cursors, and the solution of algebraic equations by a simple application of the slide rule, while the rest of the contents have been brought up to date. This hand-book is an invaluable companion to the rule, which in turn is indispensable to the engineer, whence it follows that every engineer should have a copy of the book.

"*Mechanical World*" *Pocket Diary and Year Book for* 1904. Manchester: Emmott & Co., Ltd. Price 6d. net.

This familiar handbook, now in its 17th year of publication, hardly need be more than mentioned, as its merits are well known. The section on valve diagrams has been re-written, and a table of moduli of sections has been inserted, with a variety of other tables, relating to the weight of copper bars, stresses on bolts, steam and gas pipe fittings, bevel and spur gear formulæ, &c. The electrical section does not constitute a large proportion of the book, but is well arranged and accurate; the definitions of units are particularly commendable in these respects.

Practical Electrician's Pocket-Book and Diary, 1904. Edited by H. T. Crewe. London: S. Rentell & Co., Ltd. (*Electricity*). Price 1s. net.

The sixth edition of this pocket-book has been revised, and the article on polyphase working has been re-written. The volume is very neatly produced, and the matter, as has been said before, is mainly descriptive; it should therefore be especially serviceable to the younger members of the electrical trades, and to those who wish to acquire general information relating to electrical matters.

Electric Wiring Tables. By W. P. Maycock. London: Whittaker & Co. 1903. Price 3s. 6d.

This is the second edition of the convenient little book of tables, originally brought out three years ago. It has been revised throughout, and the new wiring rules of the Institution of Electrical Engineers have been inserted, together with three new tables, one of which relates to the cable makers' standards, and another belongs to the Institution rules. This is in truth a "pocket-book"—small enough for the waistcoat pocket—and is a very handy and useful companion to the engineer engaged in installation work.

"*Practical Engineer*" *Pocket-Book*, 1904. Manchester: Technical Publishing Co., Ltd. Price 1s. net.

This is the sixteenth edition of the pocket-book, which has, as usual, been revised and brought up to date. Articles on the Stirling water-tube boiler and the Daimler motor have been added, and the section on Patents and Patent Law has been re-written by an expert. Since we first knew this publication—in its earliest days—it has undergone a remarkable development, and the practical assistance that we have derived from it in days gone by enables us to speak with confidence of its usefulness. It now comprises over 550 pages of reading matter, and there are few subjects within its scope upon which it does not contain information. Naturally, this book contains little upon electrical matters, which are dealt with in a separate volume. We may remark that the figures given on p. 535 with reference to the efficiency of electrical transmission are somewhat behind the times; the combined efficiency of 72 per cent. for the engine and dynamo, belt-driven, should be replaced by 85 per cent. for a coupled plant, or, at the worst, 80 per cent., and an over-all efficiency of at least 60 per cent., instead of 49¼ per cent., from the engine to the haulage rope is more reasonable.

"*Practical Engineer*" *Electrical Pocket-Book and Diary*, 1904. Manchester: Technical Publishing Co., Ltd. Price 1s. net.

The present issue—the fifth annual edition—has been enlarged by the addition of the standards for electrical conductors, recommended by the Cable Makers' Association, further data on conduit wiring and new types of electrical instruments, &c. We note that most of the defects to which we referred in our last review of this book have been removed, though an obsolete type of Aron meter is still described. For "Bastain," on p. 90, read "Bastian." The multi-polar dynamo described on p. 122 is wholly out of date, and, moreover, is an alternator. Much of the dynamo section is antiquated and of little use; but it is impossible, of course, to find room in a small book of this kind for detailed treatment of such subjects. Silicon is now spelt silicum, on p. 281. It is incorrect to say, of modern moving coil galvanometers, that the current strength is proportional to the tangent of the angle of deflection, as on p. 67. The matter, as a whole, savours rather of the academical, although the tables are as practical as could be wished, and by virtue of the latter the book will no doubt be useful to many.

The Ambulance Vade-Mecum. By J. F. Sutherland, M.D. 25th edition. London: Houlston & Sons. 1903. Price 3d.

This capital little pocket-guide to "First Aid" to the injured and sick ought to be found in every factory, workshop and power station; in the most concise, yet clear, manner possible it gives simple instructions for the alleviation of pain and the prompt treatment of bodily injuries, poisoning, burns, &c., pending the arrival of medical aid. There is a short section on electrical accidents, mainly directed to safe methods of removing the victim from the circuit, his restoration being effected by the treatment separately prescribed for drowning. We heartily commend this vade-mecum to the notice of engineers engaged in practical work.

Fowler's Mechanical Engineer's Pocket-Book, 1904. Edited by W. H. Fowler, Wh. Sc., M.Inst.C.E. Manchester: Scientific Publishing Co. Price 1s. 6d. net.

Apart from the usual revision and small additions to this pocket-book, the main feature of the new edition is the gas engine section, which has been re-written and now forms a very complete epitome of the theory and practice of this subject. A rather careless repetition occurs on p. 247, where three-quarters of a page is entirely reprinted, although it occurs also on pp. 242-3. Oil engines are also dealt with. A section on electric cranes is of interest, and there is a short section on electrical units, but general information on electrical matters is relegated to a companion publication.

THE UNION ELECTRICITY CO.'S SINGLE-PHASE TRACTION EXPERIMENTS.

The following particulars relating to the single-phase motor for electric railway traction, designed by the Union Elektrizitäts-Gesellschaft, of Berlin, to which we referred in our leading article on the 13th inst., may be of interest to our readers. As we have often pointed out, for long-distance main line working, the electric power must be delivered to the train at high pressure, in order to secure economy in working and upkeep and low capital cost; the use of direct

current for this purpose involves difficulties which are practically insuperable, while the polyphase system labours under inherent disadvantages which, while not insuperable—witness

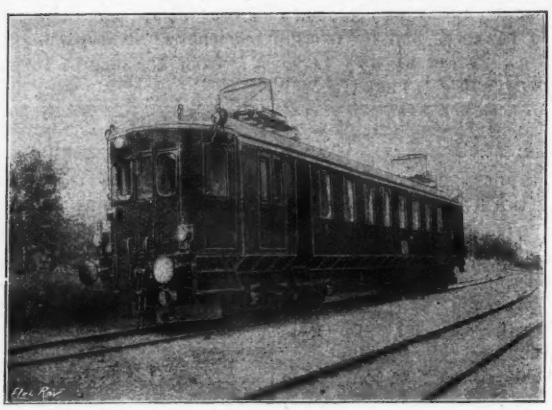


Fig. 1.—Motor-Car Equipped with Single-Phase Motors.

the Valtellina railway—are yet of very serious importance. The hopes of inventors, therefore, centred upon the single-phase system, which was free from many of the drawbacks of the rival systems, but shared what was, perhaps, the most weighty of all—the lack of a perfectly suitable motor.

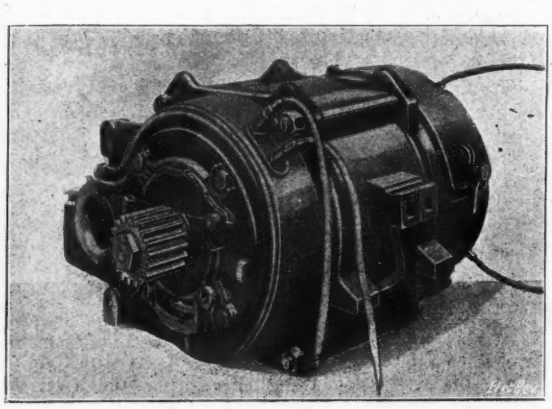


Fig. 2.—Union Co.'s Single-Phase Motor for Traction.

The Union Co., in the persons of Messrs. Winter and Eichberg, was among the number who tackled the problem, and now has two trial lines running with single-phase motors. One is a short section in the yard of the company's works, of

Fig. 3.—Union Co.'s Single-Phase Motor for Traction.

the ordinary street tramway type; it is supplied with single-phase current at 40 cycles per second, 600 volts. The test-car is equipped with two 40-h.p. motors, and the controller is exactly similar to that used for direct current; an electric brake, obtained by short-circuiting the motors, is also used. This car is the first to be constructed of a batch of 20 ordered from the company in March last by the National Light Railways Co., of Brussels.

The second line runs between Johannisthal and Spindlersfeld, and is a part of the Prussian State Railways, which has been placed at the disposal of the company for the purpose of the experiments. The line is 4·1 km. in length, of single track, with only one intermediate station. Since August last, the trial car has been in regular service; a view of it is given herewith, together with illustrations of the motors, which are rated at 125 h.p. each. The car weighs 52 tons, of which 6 tons are due to the electrical equipment; it is provided with two motors, both mounted on the same truck, and a controller at each end. Current is collected by two short bows, and passes through automatic circuit breakers and fuses. There is a small transformer in the car, from which power to drive the air pump and the controllers, and to supply the lighting service, is derived. There are no variable-resistance coils.

The motors are designed for a pressure of 6,000 volts and a frequency of 25 cycles per second, and are permanently

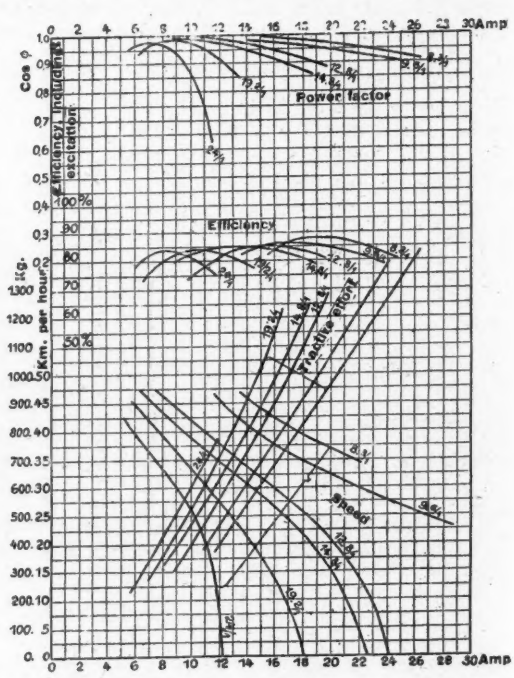


Fig. 4.—Characteristic Curves of 125-h.p. Single-Phase Motor.

connected in parallel. Their efficiency at full speed is somewhat less than that of d.c. motors, but this is made up for by the large amount of energy which the latter waste in starting. The characteristic curves of the motors are given herewith.

The 6,000-volt pressure is applied only to part of the exciting apparatus and the stationary part of the motors; elsewhere the pressure does not exceed 190 volts. For lighting purposes, the pressure is reduced by the small transformer to 35 volts, supplying the lamps in parallel; the latter are ordinary glow lamps, and show no flicker, in spite of the low frequency.

Power is supplied to the trains by an overhead wire at 6,000 volts, the return being formed by the rails. The trolley wire is suspended at frequent intervals from one or more longitudinal bearer wires in such a way as to be practically level throughout, in spite of the catenary of the bearers; further, in case of a break in the wire, the end cannot hang down low enough to endanger the lives of the railway staff.

Thanks to the possibility of supplying electricity at the full line pressure to the motors, with the exception of about $\frac{1}{6}$th part of the power, which is transformed down for excitation, the apparatus carried on the car is light and the efficiency is maintained at a high value. The comparatively high frequency which can be used with the Union motor—up to 50 cycles per second—is also a great advantage, both in facilitating the lighting of the trains and in enabling the

supply of power to be obtained from stations designed for the general supply of lighting and power. The elimination of rotary converter sub-stations entirely, and the reduction in the number of transformer stations required, thanks to the high pressure practicable, are obvious and most important advantages, while the simplicity of a single overhead wire, carrying only a small current, is of fundamental importance.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week.

Steam Turbo-Generating Plants.

Permit us to assure Mr. Wilkinson that we have not intended to insinuate anything beyond what we have said in our letter. We called the statements extracted from his paper misleading, because these incorrect statements were largely used in his argument. As he does not in his reply dispute the inaccuracies, the remarks in our previous letter still apply to the facts. Mr. Wilkinson is evidently not aware of the extent to which superheated steam is being used with reciprocating engines in central stations. Hundreds of our engines working under superheat, some for four or five years, show that the troubles Mr. Wilkinson anticipates are purely imaginary.

Our triple-expansion engines expressly built to use superheat without risk, have shown benefits so great that nearly all up-to-date central station engineers have in their specifications insisted on superheat for some time past.

The difficulty with the turbine under superheat is due to the expansion which necessitates a considerable increase of the usual clearance to avoid the risk of stripping the blades when the maximum possible superheat comes on. This might be arranged for if the superheat could be kept constant, but as this is impossible, there must, on account of the excessive clearance, be a large increase of leakage under the normal working conditions.

We accept Mr. Barker's correction of Mr. Wilkinson's mistake. Mr. Barker, however, is wrong in his further remarks. Results have been published in one or two papers of the trials of a 500-KW. Parsons turbo-alternator, running at 2,500 revolutions with 140 lbs. steam without superheat, from which it will be seen that the actual benefit per inch of vacuum runs out as follows :—

Vacuum.	Loss or gain.
22 in.	...
23 in.	4·85 per cent.
24 in.	4·73 ,,
25 in.	4·2 ,,
26 in.	4·38 ,,
27 in.	3·75 ,,
28 in.	3·9 ,,

The fact that the benefit or the loss per inch increases as the vacuum is *reduced*, with the steam turbine, does not appear to have been noticed by Mr. Barker, and we do not think that it has been seriously noticed by others; but the reason is obvious, and it shows to the central station engineer, whose vacuums do occasionally go down to 23 in. or 24 in., instead of the 27 in. to 28 in., at which we all aim, how big a loss he may look forward to if circumstances will not permit him to keep his vacuum approximately perfect.

Now we have taken from the above table 13·2 as an approximate figure for the 4 in. from 27 in. downwards, and this is about correct. Mr. Barker gives 2 per cent. loss per inch at 24 in., but this certainly should be doubled if we have to accept Mr. Parsons's figures, and Mr. Barker's inferences will consequently be incorrect.

A number of our engines have been re-tested after several years' work, and we would call Mr. Barker's attention to Mr. Minshall's paper, published in the *Proceedings of the Institution of Civil Engineers*, Vol. cli., issued March, 1903, where such re-test results, under unimpeachable and experienced expert supervision are given, and show an improvement and not a loss of efficiency after years of working. This is not an isolated instance, but the usual result, and naturally so, as the steam wearing surfaces of a reciprocating engine are easily kept efficient. With the steam turbine on the other hand, the continual increase of clearance going on, due to wear or distortion of blades, must cause continous loss of efficiency from the time the first test result is made until new blades are fitted. What this lost may amount to exactly it is difficult to say, but as Mr. Wilkinson prefers to compare results "under actual daily working conditions" and to have "the outcome of everyday practice," we submit the following table, giving the results of a year's working of all the provincial central stations we know of where steam turbines are used to any extent for electric lighting :—

Station.	KW. capacity.	Total units sold.	Coal and other fuel.	Oil, waste and stores.	Works costs.	Total costs.
			Pence per unit sold.			
Steam Turbines :—						
Blackpool ..	3,050	2,169,463	·91	·10	1·52	1·76
Newcastle District	2,500	1,619,671	·69	·12	1·22	1·63
Cambridge ..	1,500	419,005	·66	·14	1·57	2·40
Scarborough ..	1,085	431,777	·85	·08	1·61	2·65
West Bromwich ..	650	285 848	·55	·11	1·10	1·79
Morecambe ..	700	202,967	1·28	·14	2·61	3·81
Melton Mowbray	150	43,742	·93	·12	2·19	3·05
			Average ·84d.	Average ·11d.	Average 1·7d.	Average 2·37d.
High Speed Reciprocating Steam Engines :						
Leeds	8,740	4,448,650	·28	·03	·62	·89
Halifax	3,000	2,557,548	·48	·10	1·09	1·47
Bootle	850	1,619,129	·41	·08	·70	·88
Taunton	1,080	646,273	·70	·06	1·05	1·54
Darwen	900	545,856	·65	·10	1·10	1·34
King's Lynn ..	520	286,679	·59	·09	1·26	1·75
Salisbury	200	150,222	·46	·07	1·21	1·80
			Average ·51d.	Average ·07d.	Average 1·0	Average 1·38d.

The figures are taken from the latest official returns published in the electrical papers, and for comparison, we give from the same official returns an equal number of stations with reciprocating engines under approximately similar circumstances as to costs of labour, fuel, output, &c. The results are interesting, and show that the steam turbine stations on the average are quite 50 per cent. worse than the reciprocating engine stations, not only in the fuel used but in the total cost per unit of electricity produced.

These officials returns, if brought up to date, might possibly modify the results in favour of the reciprocating engine or otherwise by a decimal point or so, but the superiority shown by the reciprocating engine is too large to enable steam turbine advocates to quibble it away at present. We may say that the reciprocating engine stations have been chosen by us with as much absence of bias as possible, and we might have selected, for example, 38 stations showing an average of ·41d. for fuel cost, instead of the ·51d. we have accepted for comparison sake. These figures are the only official ones at present published, and they should, in our opinion, at least give pause to the enthusiasts who want to rush the steam turbine for central station work.

Turbine enthusiasts appear to lose sight of the fact that the steam engine has not been standing still during the last few years, but has been largely improved by the judicious use of superheated steam in specially designed engines. The reciprocating steam engine, in fact, is still far ahead of either gas engines or turbines for economy of fuel on the average station loads, and for comfort and reliability of running, on which the reputation of the station more immediately depends, there is no question as to the superiority of the steam engine.

For **Belliss & Morcom, Ltd.**
ALFRED MORCOM, *Managing Director.*

Birmingham, November 18*th*, 1903.

THE Record.

[The anti-climax to the account of "The Greatest Electric Shock on Record," in our issue of November 13th.—EDS.]

For sheer ornamentalism, with details that none but an American paper would publish, the cake has been taken by a page of the Sunday issue of the *New York Herald* (November 1st last). On this side we have had nothing like it—for which we may be truly thankful—not least, those members of the Institution who discussed the papers by Major-General Webber, Mr. Aspinall, and Mr. Trotter early last year. The details are, in more senses than one, shocking. To commence with the headlines, which read :—

"Alive after 3,300 volts through his brain."

"Astounding Survival of Frederick Flad from Tremendous Shock."

"His Fearful Visions of Hell and Demons."

Below these are various illustrations, a centre-piece suggesting an electric (?) belt advertisement, external and internal views of the Kingsbridge power house, a clothed portrait of the victim, and a photograph of the injured parts (unclothed) which might have appeared in the *Lancet*, or have been decently hidden from the public gaze in the reproductions of a medical museum.

Then follows the "copy." Exigencies of space and the decencies of journalism necessitate the collecting of gems of scientific description and the ruthless omission of those portions which any English sub-editor would have rejected as blasphemous.

"He was holding up a joint of iron pipe conduit . . . . at the time which a workman named Mallory was measuring it, when a plank on which Flad stood tipped. To save himself from falling on a nest of deadly wires below, he threw up his arms to get his balance, touched other wires, and like a thunderbolt, twice the voltage required for electrocution in Sing Sing prison, shot through the insulation and through his body.

"Flad straightened up, and as he stiffened like a corpse his head came near enough to still other wires above to form a complete circuit. Mallory saw a stream of blue flame 18 in. long and 6 in. wide roaring out of Flad's head with the noise of a trolley car. He saw the flame melting the iron pipe above, and the molten metal dropping white and hissing on the back of his head. How could the man be saved? . . . Men and clothing steaming with perspiration were perfect conductors of the awful current. . . . Mallory was an expert. . . . Instantly, like a catapult, he hurled himself headlong against the paralysed burning man, broke the circuit, and they both tumbled to the floor together. . . . A dozen electricians leaped to his side, took in the situation, and while Flad was still roasting and smoking, began the resuscitation methods used in cases of drowning. . . .

"The great engines, big enough to run an ocean steamer, were throbbing and thundering; the big dynamos were roaring like a tornado, and the brushes bathed in blue flame were sending their currents to all the lines between Harlem and Yonkers. . . . Traffic could not stop, even for a dying man. . . . Fully one-half of this Niagara of bolt lightning had passed through the human body over which strong men were working and a clergyman praying."

Omitting the irrelevant, if not irreverent matter, we can peruse some more of the opinions that the indefatigable reporter collected respecting this matter. "An expert said, after some figuring, that the voltage which had shot through Flad's body was three times greater than the current required to run an elevated train. The current that flamed from Flad's head would have run 50 cars on the suburban lines, or 100 ordinary Broadway cars. . . . All agree that no case on record can compare with Flad's. No man, they say, ever received half the number of volts through his body, and lived on. . . . Flad told me that electricity was still coming out of him. . . . Friends declare that, when standing on a wet pavement, if they touch him they are shocked."

After the vivid description of the 18 × 6 blue flame roaring out of Flad's head, the end of this veracious narrative, with its remarks anent a lawsuit between Flad and his employers, is lamentably prosaic.

It is, perhaps, a comfort to reflect that there are yet depths to which our non-technical but popular journalism has not descended. The nearest we have got to the milder of the unquoted parts suggests a patent medicine advertisement, while the whole savours of a sale, on the instalment system, of an Encyclopædia. To misquote Kipling:—

> It is not pretty,
> It certainly isn't scientific,
> But, do they call it art?

Turris.

Electric Shocks on Flat-Back Switchboard.

The struggles for life and the miraculous hair-breath escapes behind the H.T. switchboard on the Canadian-American plant at Parnahyba, Brazil, recorded by Mr. Davids in your last issue should serve as a useful lesson in switchboard practice and a fitting example of the danger experienced on faulty designs. It must also appeal to many engineers in this country with a sense of gratitude to our British firms, who, in spite of the extra cost thereby involved, have set themselves steadfastly against switchboards with backs and such-like dangerous places. Imagine, for instance, to what extent the death-roll on switchboards in this country would have been increased if the two or three hundred odd H.T. switchboards installed by Messrs. Ferranti had been of the type used at Parnahyba instead of the safer cellular backless switchgear which has become standardised with us.

It would be interesting if you could publish an illustration of the switchboard described by your correspondent, showing the front and back of this apparatus with the old metal and new wooden framework. If I may add a word of advice, I would urge your correspondent not to be deluded into thinking that the protection and safety essential to such work is ensured by only replacing the metal framework by wood. Flat-back switchboards in this country have been made with wooden frames, and their unreliability has been proved by the fact that a number of them have been replaced by cellular backless switchgears. Islington may be quoted as an example. A wooden framework does not give all that is required to correct the glaring faults which are inherent to the flat-back switchgear design. These faults endanger the life of attendants, and are conducive to disaster by fire.

H. W. C.

The Presidential Address and the Edison Battery.

I notice Mr. R. Kaye Gray, in his Presidential address, delivered to the Institution of Electrical Engineers on 12th inst., referred to the Edison nickel-iron cell, which he said "appeared to be on the verge of adoption on a commercial scale." He is further reported to have declared that "there seems to be no question that the cells have fulfilled the claims made for them, and that their introduction in quantity will give an immense impetus to the electric automobile industry, and even to accumulator traction in general."

Might I ask Mr. Gray to what claims he refers? Is it to the claims with which we have grown familiar in the daily press during the past two or three years, such as that the new batteries can be put into half the space of the lead battery, or that they give as large an output as the latter, with half the weight? Such claims have been repeatedly advanced, and if this is what Mr. Gray means, it would be interesting to learn the nature of the evidence on which his assertion is based.

It is exceedingly difficult to ascertain what are Mr. Edison's own claims for his battery; and if, as one would seem justified in inferring from his remarks, Mr. Gray has any special or definite information on the subject, I think the public would be glad to learn its exact nature.

Such figures as have been published by the Edison Co. appear to show that the new battery—at any rate, as manufactured at present—develops less power, weight for weight, than the best lead batteries in use for automobile purposes, and requires at least 50 per cent. more space than the latter, besides being much more expensive.

We have heard so often and for such a long time that the battery is "on the verge of adoption on a commercial scale," that one may be excused for receiving the latest report *cum grano salis*, even though it emanates from such a distinguished source as the President of the Institution of Electrical Engineers.

David Smith,
Secretary, Electrical Power Storage Co., Ltd.

London, *November 18th*, 1903.

Electricity India—A Correction.

Allow me to comment on your Bombay correspondent's article in your issue of October 9th, page 600, in the whole of which there is scarcely a correct statement.

There has not been a single fatal accident from overhead tramway wires; the "repeated deaths" from this cause are an absolute fiction.

Madras did not follow Calcutta, the tramways there having been electric for many years.

The consent of the local authority is not a condition precedent (or otherwise) to the grant of a license under the

Indian Electricity Act, 1903. The regulations, of which he gives copious extracts, have not come into force.

Finally, the control of what he calls "private installations" has been in the hands of Government since the passing of Act XIII. of 1887.

X. Y. Z.

Calcutta.

An Early Start.

With reference to your paragraph in last week's notes, "Who are H. W. Bramley & Co., electrical engineers?" I beg to state that being struck with the miserable sallary earned by a junior engineer, and being the fortuneate possessor of the nescessary capital, I turned my efforts to a venture in this direction. Shurley this offered brighter prospects than the centeral station? At any rate, it afforded me a respectable income and a rapidly-increasing high-class business. As regards the claim of £4 15s. 6d. for repairs done to bycicle, I will only say the way in which the nescessary work was carried out, would be a ——— to the smallest firm of cycle engineers, leave alone a so-called "Imperial" Motor Car Co.

H. W. Bramley.

Ilford, *November 23rd*, 1903.

[Our correspondent might with advantage have completed his education—at any rate to the fifth standard of the Board Schools—before starting a high-class business.—Eds. Elec. Rev.]

Main Line Electric Traction.

I think it will be generally agreed that, as "Multiple Supply" says, the best solution of the main line electrification problem is the combination of the new single-phase motor (assuming that it is as perfect as it is said to be), with what he calls the "multiple supply" system, a system for which he has apparently taken steps to obtain patents. I have read the article in your issue of the 6th inst., to which "Multiple Supply" refers, and in which the multiple supply system is described, and should like to point out that I hold a patent for the very same arrangement of alternating current supply and batteries on the trains described therein, so that the idea is not quite new.

C. H. R. Thorn.

London, S.W., *November 21st*, 1903.

The Latest Dodge in Dumping.

It may be of interest to your readers to learn the latest method employed by a Continental firm for getting their goods on the English market. Twelve months ago a German accumulator company made a great effort, by means of a nice catalogue printed in English, and numerous and pushing agents, to persuade the English contractors to buy their goods at almost any price short of giving them away, and certainly at a price which appeared to represent bare cost of raw material and labour. It is a pleasure to record that contractors in this country preferred to buy in the Home Markets goods of which they knew something, so that the effort was apparently a failure.

There now appears another pretty catalogue, with even lower prices, dated March, 1903, and bearing the name of a company with an aggressively British title and with a London address. On comparing this catalogue with the first one, referred to above, there is not the least doubt that they proceed from the same source, as they are practically identical except for obviously studied alterations.

It is within the writer's knowledge that representatives taking this catalogue round to the Trade are, when questioned on this point, hinting vaguely at works which either are or will be in the "North of England," but as the goods are all quoted f.o.r. English port, this seems open to question.

It is to be hoped that buyers of accumulators will not be taken in by this dodge, and deluded into thinking that they are supporting home industries, because they are dealing with a company having such a very all-British name.

An English Battery Maker.

Destructors and Electricity Works.

I have just read your leaderette on Mr. Schofield's paper, and I desire once again to draw attention to the fallacy which seems to be so common in regard to the stoking of refuse in combined electricity and dust destructor works. Both Mr. Schofield and yourselves appear to consider that the cost of stoking the refuse should be charged to the electricity works as a set-off against the steam value. This is not so, and cannot be so, as a dust destructor is erected, generally speaking, for the purpose of destroying refuse, and the refuse will have to be stoked whether the destructor is combined with electricity works or not. The value of the steam cannot therefore be stated in terms of the cost of labo for stoking. As a fact, the cost of stoking in well-de ned combined works, so far as coal-fired boilers are co.. erned, is considerably reduced, and in addition to getting the steam as a by-product costing practically nothing, there is a gain also in a reduced wages bill.

If the cost of stoking the refuse is to be debited against the electricity works, why not the capital charges upon the cost of erecting the dust destructor, and also other charges incidental to the working of the destructor?

Looking at the question from a broader standpoint than a mere departmental one, if an appreciable quantity of steam is raised from the burning of the refuse, and can be usefully employed in the electricity works, surely it has a certain coal value which must be directly gained by the ratepayers, providing always that no additional cost has been incurred by combining the undertakings.

The whole question is a little involved, and I hope shortly to have e opportunity of dealing very fully with it.

W. P. Adams.

London, E.C., *November 20th*, 1903.

[W are much indebted to our correspondent for his persiste efforts to set us right, and look forward to his "dealing very fully with the whole question," which he considers to be "a little involved."

If the facts be that a sanitary department charges the electricity works with the costs of stoking the refuse, there is no fallacy, either on our or Mr. Schofield's part, in comparing these costs with the steam value of the refuse.

Mr. Adams appears to think that the steam generated in the destructor boilers is a bye-product which costs nothing, and should be treated by the electricity works as a free gift. But the sanitary department has a perfect right, and has sufficient common sense, to charge a proper price for any steam delivered to the electricity works.

When our correspondent finds the opportunity to "deal very fully with this involved question," might we suggest that he do not fail to note that a boiler and economiser, with its accessory piping, &c., are not essential to the burning of refuse, and therefore steam is not a free and indispensable by-product; and that a destructor worked *as a destructor*, and not as a steam raiser for a small electricity works, might easily be from half to one-third the size required in the latter case, in that it could work continuously, and therfore more efficiently. We reserve further comment until the fuller treatment by our correspondent justifies it.—Eds. Elec. Rev.]

Technical Instruction.

Permit me, as an old reader of the Review, to point out that whilst the letter of your correspondent dealing with technical instruction has a very high value as grievance literature, it only turns inside out a sixth place decimal part of that anomaly, miscalled "technical training."

Now, according to Mr. Swinbourne, if science is to be worthy of the name, it must be "knowledge of nature

utilised by man." Admitting the complete truth of this statement, a simple process of reasoning drives a thinking and keenly observant mind to the conclusion that most of the technical instruction, so-called, in this country is an absolute farce, due, in no small measure, to the science masters who have the appointing of instructors, who are moulded according to their own wretched notions of what constitutes orthodox qualification, *i.e.*, a certificate from some recognised institute of technology. But, Sir, does not the possessor of this precious piece of parchment know what happens when a piece of glass is rubbed with cat's fur ?—sex no object. And just think for one moment what an enormous technical value the expert manipulating of pith balls has in the fitting of a student of electrical engineering for a fight in after life in the world of engineering, the fierceness of which he has not yet even dreamt of. Yet how many of these graduates know how to apply Ohm's law to practical problems, dealing with the modern design and construction of electrical apparatus ? I do not know of any. Of course, this is a negligible essential, the science master's "book" is quite sufficient, not omitting, of course, the cat's fur and pith ball exercises.

Yet, let a man with 20 years' experience, covering almost the whole range of engineering—electrical and mechanical—and a mind stored with Goodeve, Parshall and Hobart, &c., compete with one of these cat's fur men for a vacant position, and 99 times out of 100 he will be unsuccessful.

Reason, if we let it perform its proper function, divides all knowledge into two quantities—useful and useless. There is no half-way house about it; and sorted out upon this basis, your modern graduate of technological institutes becomes a mere tinker, and a human encyclopædia of useless information.

Arc.

[Again we must point out that our correspondent goes too far. That the qualifications of technical instructors are too often deficient we agree; that science masters are all fools is an absurd suggestion.—Eds. Elec. Rev.]

Waste of Energy in Tendering.

Your correspondent "R. A." in last week's issue, who modestly writes as a "small man" with a fear that his ultimate destiny is in running a baked potato can, need have no fear of exclusion from a consultant's invitations to tender if his work is satisfactory, and provided that the said small man is known.

In the event of the suggested arrangement being adopted of issuing specifications to six electrical firms, the small man need not necessarily be left out, but would be called upon periodically to quote when work was required with which he was able to deal.

Naturally, for an extremely large job a small contractor would not be asked to tender, and the same applies under existing circumstances; and if a small contractor is not known, then the surest way of impressing the knowledge of his existence upon consulting engineers is to apply for membership to the London Electrical Contractors' Association, lists of whose members are shortly being issued to consulting engineers.

Edw. J. Hogan.
Hon. Secretary.

London Electrical Contractors' Association.
November 23rd, 1903.

The Broadness of Electrical Engineering.

I am quite prepared to admit the fascination of electrical engineering as pointed out by Mr. E. Kilburn Scott, but I should like to know how the young engineer is to obtain all this and yet remember that his main object is to make a decent living.

Take the case of an engineer who has been out of his apprenticeship about three or four years, during which period it has been, and still is, an open question which is going to be the best for him to pursue; viz., single or polyphase alternating, two-wire, or three-wire direct, &c.

He cannot follow them all and have a practical experience of them, unless he care to be always working for experience and no salary, and this becomes a trifle monotonous in time.

A Young Engineer.

The Functions of the I.E.E.

It appears to me that Mr. Gray's remarks regarding the proper scope of the Institution of Electrical Engineers have been, to some extent, misunderstood by the electrical Press.

I would, at any rate, venture to express my own view on the subject with every deference to those who differ with me. In my opinion, the Institution of Electrical Engineers should, in accordance with the terms of its charter, be all sufficiently concerned with the technical work of an electrical engineer, leaving the business side of all questions in the hands of those who are responsible for the administrative and commercial working of their respective electrical undertakings. I am quite ready to admit that more often than not the successful engineer is successful because he possesses a business mind, or has had a commercial training. That, however, is no argument against a separate association for dealing with the business aspect of things electrical; and anyone who is serving in the double capacity of director (or manager) on the one hand, and engineer on the other, would naturally seek attachment with both headquarters.

I venture to suggest that a great deal of the work that certain prominent members of the Institution are engaged upon in connection with pressing claims for revising legislation and such-like, is far more connected with their interests as business men than as engineers, and that, as there is an abundance of such work ahead, it would be as well if a separate body were formed to attend to it.

The very constitution of the Institution shows that its work is really strictly technical. Thus, those who are only associated with electrical work from a commercial point of view, are classed as Associates; yet obviously these, rather than those who have attained academic or technical distinction, are the most suited for urging legislative reforms.

Again, it has been suggested that the proposed tariff reforms should be discussed in their relation to electrical work; but here again, surely those who would be best adapted to represent the Institution are the "men of affairs" rather than those who, as distinguished engineers or electrical *savants*, are prominent members of council, or vice-presidents. Tariff reform on an Imperial basis is a subject I myself have been very deeply interested in for some years, but not as an electrical engineer any more than as a mere consumer of bread, and I should certainly not look to an Institution of Electrical Engineers to take the matter up. On the other hand, I *should* expect an association concerned with the commercial aspect of electrical undertakings to inquire into the matter in connection with their interests—and with useful results.

We might surely do worse than note the way such institutions as the Institution of Civil Engineers regard the difference between technical (or scientific) work on the one hand, and business on the other.

Certainly, if a "Temple of Engineering" were ever to be realised, that—as a sort of enormous trades union, of the right type, to guard and agitate the interests of all the trades concerned in any form of civil engineering (mechanical, railway, electrical, &c.)—would be the most suitable channel for dealing with reforms, associated with the business, as opposed to the technical, side of electrical work. Meanwhile, there would appear to be ample scope for an association to take up the interests of "commercial electricity" as distinct from the interests of those who, as engineers, *render* electricity a subject of commerce. I am aware, however, that a new body such as I speak of would, at first, be open to the objection of carrying less weight in name; but it would be more in accordance with reason.

Charles Bright.

Westminster, *November 24th*, 1903.

Jointless Section Induction Coils.

In reply to Mr. Leslie Miller's remarks in the Electrical Review of the 20th inst. (following the order of his letter), I beg to point out that at the recent meeting of the Röntgen Society to which he refers, I produced the tools used for the single wire sections in the special coil for Mr. Baines in 1868. The tools were passed round the room, and presumably seen by Mr. Miller. He makes reference to what he calls the "insulation" in my coils, asserting that it is far

less than is the case—instead of being less than the example he gives of sectional insulation, it is many times greater, as I determined by special test on Friday last.

I must maintain my views, already expressed, in reference to the effect of compression on a soft insulator.

It is, perhaps, unnecessary to take much notice of Mr. Miller's attempts to determine who is an "authority" on induction coils, and not very wise to adopt the extraordinary argument that one who has devoted more than 40 years to the theory and practice of this special branch of electrical work must necessarily know exceedingly little about it, and that, too, notwithstanding the production of the Polytechnic coil in 1868 of 29½ in. spark, charging 66 Leyden jars, each of 11 gallons size, in 25 seconds; also of the Spottiswoode coil, 42 in. spark, in 1876, and a 4-ft. spark coil for the Lords Commissioners of the Council on Education in 1902. I respectfully submit that it is not for an isolated individual, and most certainly not for one engaged in making electrical apparatus, to determine who is an "authority" on induction coils. It is clearly a matter for the scientific world generally.

As to Germany, it is proper to say that I export coils to that country.

It is not necessary to refer to the Cantor Lectures by Prof. Fleming, as so good an authority would be aware that the best coils were tested with a condenser in parallel (which has always been my practice). This method of testing has, no doubt, been more largely urged recently on account of the use of coils in wireless telegraphy, and I have no doubt that was the view expressed or implied in the lecture.

As to Tesla, permit me to say that I am aware of his work in connection with induction apparatus, as well as that of Edison.

Mr. Miller's concluding remarks are inaccurate, as no such things as he suggests can be traced in any of my statements.

In conclusion, may I add that the special coil of 1868, designed and made by me, had not "air spaces," and it was made with single-wire windings or sections precisely of the thickness of those Mr. Miller recommends. The sections were closely cemented together with proper insulation between them, and the ohmic resistance of the secondary coil was extremely low.

Alfred Apps.

London, *November 24th*, 1903.

Heating Capacity of Electric Radiators.

In a price list referring to electric heaters just issued by Messrs. Falk, Stadelmann & Co., Ltd., of Farringdon Road, they state "while existing heaters, according to maker's lists, consume for the heating of about 1,000 cb. ft. of air 1,000 watts, the patent Phœnix heater gives the same result with a consumption of only 400 watts, consequently the cost of heating by other apparatus is 2½ times more." Also that "for efficiency, it is not necessary to consider the radiators which are provided with incandescent lamps, their consumption of current, which is from 10 to 12 amperes per lamp, putting them out of the question where economy is an object."

Seeing that there are a number of different makes of electric radiators on the market which have an efficiency of over 80 per cent., it would be interesting to learn how Messrs. Falk, Stadelmann & Co., Ltd., have achieved such an astonishing result, unless, indeed, the matter must be looked upon as a trade secret!

With regard to current-consumption of radiator glow lamps, it is very interesting to learn that a 250-watt lamp always takes 10 to 12 amperes!

The British Prometheus Co., Ltd.
H. Skipwith, *Manager.*

Kingston-on-Thames, *November 23rd*, 1903.

As it has come to our knowledge that certain makers of a radiator called the "Phœnix" (which is not designed on the same system as our Aston patent radiators at all), claim that they are more efficient, we think it well to draw the attention of the trade to the fact that the lamps used in our radiators only take one-fifth of a Board of Trade unit each, and not 10 to 12 amperes per lamp, which the makers of the Phœnix radiators profess radiator lamps consume. If, as possibly may be the case, it is a misprint in their list, and they intend it to read 1 or 2 amperes, we think the least the manufacturers of the radiators can do would be to correct the misrepresentation through the medium of your columns.

Veritys, Ltd.
C. S. Northcote, M.I.E.E., *Manager.*

London, W.C., *November 23rd*, 1903.

[There is apparently a surprising amount of misunderstanding and misdescription in connection with electric heating apparatus. We are told that the lamps in a certain radiator take only one-fifth of a Board of Trade unit each. This amount of energy costs, at heating rates, say ½d. Are we to assume, then, that when the lamp has "taken" one halfpennyworth of electrical energy, its mission is fulfilled? We rather think that, with a life of, say, 500 hours, the lamp will dissipate something like 100 Board of Trade units. In fact, the expression used is simply meaningless. As for the statements which have called forth these two letters, they are equally absurd. Seeing that the energy supplied to the radiators is degraded wholly into the form of heat, save for the 2 or 3 per cent. given off as light in the case of the incandescent lamp type, to claim that one radiator will heat a given *volume* of air with only two-fifths the *power* used by another radiator for the same duty is preposterous. Radiators compete only in durability, elegance, convenience, prime cost and similar features; on the score of efficiency one is every bit as good as another.—Eds. Elec. Rev.]

Electrical Persecution.

I notice in your last issue that the U.D.C. of Sutton are making a complaint on the score of vibration against the local lighting company.

As a temporary visitor for a few weeks within the zone of vibration, may I give your readers a few particulars which may enable them to appraise the value of the complaint.

The station has the railway embankment along one side, and is surrounded on the other three sides by a large vacant space; between this again and the houses there are rather unusually long strips of garden.

I happen to be living in the house that appears to be the nearest in a bee line to the station, say, 200 yds., probably more, and in quiet intervals when there are no trains and with a strong effort of listening I can hear a very slight hum if the wind is in the right direction; on the other hand, I have to shut my bedroom window to keep out the racket, whistling and roar of the trains. Is not this another sample of those querulous gentlemen who allow the G.P.O. to make the face of nature hideous with their telegraph poles, without a word of complaint, but are up in arms at once if a company wishes to put up an overhead wire, be the support ever so ornamental or the surroundings ever so sordid?

Visitor.

Sutton, *November 23rd*, 1903.

Applicants Please Note.

I have recently had to read the numerous replies received to an advertisement inserted in the Electrical Review.

Candidates were invited for a post where certain stated qualifications were necessary, and it was essential that the post be filled by a young unmarried man.

While many of the candidates stated just the information required, viz., age, training, posts filled, and present occupation, a great number, I regret to say, omitted much that one desired to know, substituting quite irrelevant information, including considerable personal estimation of ability.

To the number who wrote for further information about the post, needless to say, no reply was sent.

I give this information, in the hope that it may be of service to the number of electrical engineers who at present, apparently, desire to change their posts.

Naturally one selects, in the first instance, the letters supplying the information wanted, and exhausts them first.

Selection.

November 24th, 1903.

[Electric Welding.—We have some replies for "Welder" whose letter appeared in our issue of November 6th (p. 735), but have mislaid his address.—Eds. Elec. Rev.]

OUR LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.]

"Inquirer" writes:—"The principal tradesmen in the small town in which I reside are anxious to have the benefit of lighting their shops by electricity. A firm of electrical engineers have expressed their willingness to carry this out as a private undertaking. The District Council were asked to give the necessary permission to open the public roads in order to lay the main. This body, while strongly supporting the proposal, found they had not the power to grant their permission. They, however, forwarded the application, accompanied with a strong expression of approval, to the proper authority, namely, the County Council, who, without any difficulty, immediately sanctioned the proposal. In the meantime it was discovered that another party held the provisional order for lighting the whole district. This provisional order has been in existence for three years, during which time no steps have been taken to carry out this order, and it is very questionable whether any are likely to be taken.

"Believing there are many other such cases, I shall be much obliged if you, or any of your readers, can give me any advice as to what steps should be taken in the matter."

*** The interesting question addressed to us by "Inquirer" has been dealt with in some shape or form on previous occasions in this column. What he in substance asks is:—If a provisional order has been granted for a district, has the body or company which holds the provisional order a monopoly for supply in that district? The answer to this question is "No," and this, whether it is sought to entrench upon the supposed monopoly by obtaining another provisional order or by private enterprise. "Inquirer" does not state whether the "party" who holds the provisional order is a company or the local authority. It is presumed, however, from the context that not only do the local authority not hold the order themselves, but they are willing to assist him in his enterprise. In these circumstances it is quite clear that the firm of electrical engineers can commence to supply electricity without any reference to, or consent from, the party who has got the provisional order. The fact that such a body has no monopoly is made quite clear by the Electric Lighting Act, 1888, Sec. 1, which provides that:—"The grant of authority to any undertakers to supply electricity within any area, whether granted by licence or by means of a provisional order, shall not in any way hinder or restrict the granting of a licence or provisional order to the local authority, or to any other company or person within the same area." This makes it quite clear that the electrical engineers may make an application for a provisional order in order to supply electricity.

But a provisional order is an expensive luxury, and one of its main objects is to ensure that the undertakers (*i.e.*, the persons who promote it) shall be able to obtain the consent of the local authority to the laying of cables, &c., in the streets. In the case under notice, the local authority are anxious to give every facility, and it is, therefore, conceived that there is no necessity for "Inquirer's" friends to go to the expense of a provisional order. It is often assumed that electricity can never be supplied except under a provisional order or special Act. This is not the case. So long as certain requirements laid down by the Board of Trade as to the use of overhead wires, &c., are complied with, any person may sell electricity to his neighbours. Before the supply is commenced, and if it is found necessary to lay overhead wires, a copy of the Board of Trade regulations on the subject should be obtained and their contents carefully noted.

LEGAL.

Electrical Publishing Co., Ltd.

In the Chancery Division of the High Court of Justice on Tuesday, Mr. Justice Buckley, sitting for the disposal of companies' business, had before him a petition to wind up the Electrical Publishing Co., Ltd., the petitioner being Thomas Wm. Sheffield, of Trevellyan Buildings, Corporation Street, Manchester.

Mr. Astbury, K.C., for the petitioner, said the company was formed in July, 1902, for the purpose of carrying on the business of and publishing an electrical review, with offices in London. The nominal capital of the company was £14,500, of which £3,800 had been allotted. It was not quite correct to say that all the shares were paid up; only part were paid up. The object was to carry out an agreement with one Theodore Feilden, who was to be the editor and publisher of this magazine. By the agreement of July, 1902, referred to in the memorandum and articles of association, it was provided that the company should acquire the publications, meaning thereby the copyright of the title of the *Electrical Magazine* and other property and assets from Feilden, who was appointed managing director and editor of the publication, in consideration of which the vendor was allotted 5,500 ordinary shares and 1,000 preference shares, and the remuneration for his services was to be £6 per week from the date of the registration of the company up to the date of the publication, with travelling expenses in London at 10s. 6d. a day, and in the provinces at £2 2s. a day. What the petitioner complained of was that Feilden had nothing to sell. It turned out that there was no publication, and no preparation for publication. Mr. Feilden had been going on drawing money from the company, and great pressure had been brought to bear upon him. He now suggested that he might publish the magazine early next year, but nothing had been done at all, and petitioner alleged that the company was simply a company for putting a monthly or weekly sum into Mr. Feilden's pocket. The petitioner set forth that the company went to allotment in June, 1902, and at the date of the balance-sheet of June 30th, 1903, 9,099 ordinary shares and 2,255 preference shares, including the vendor's, had been issued. Theodore Feilden had continued to draw his salary and expenses, and a sum of £1,350 2s. 7d. had been expended on managers' salaries, directors' expenses, office furnishings, stationery, and other expenses at the date of the balance-sheet, leaving a balance in the bank at that date of £1,012 17s. 7d. Between the months of March and September, 1902, there were circulated a large number of copies of the prospectus of the company, and many copies of the prospectus were distributed amongst electrical engineers, general engineers and members of local authorities. The prospectus contained, among other statements, the following:—"The maturing of Mr. Feilden's project has been the work of much careful thought. In the result Mr. Feilden has conceived and perfected a magazine entirely different to anything hitherto existing in this or any other country, rivalling the best productions of the United States, which are such enormous successes. In effect an international monthly record of things electrical, a compendium of information which would form an indispensable adjunct to every worker and thinker in electrical science and progress. A journal presenting the mature thoughts of the pure scientist and authority in carefully selected signed articles. Expert description, fully illustrated, of the latest and best productions of the engineer and manufacturer of every country. Further technical details of the electrical magazine it would be impolitic to divulge, but leading authorities who are interested in the enterprise have declared that the publication is virtually unique in its comprehensiveness and utility." The petitioner, upon the faith of the statements contained in the prospectus, which he believed to be true, applied for, and was allotted, 100 ordinary shares of £1 each, and had paid up £50 in respect of the shares, and induced many of his friends to take shares in the company and to promise to support the magazine with advertisements and subscriptions. The allotment took place in June, 1902, and the petitioner, relying upon the statements in the prospectus, that the magazine had been perfected and approved by leading authorities and that a profit was anticipated on the first year's working, expected the magazine to be published at once, and frequently urged Feilden to publish the magazine. In April, 1903, a paragraph appeared in the *Electrical Times*, commenting unfavourably on the delay in the production of the magazine, and plainly insinuating that Mr. Feilden was working for his own interests and not for those of the shareholders. It was a very bitter paragraph. The petitioner called Feilden's attention to the article, and Feilden said he would take proceedings for libel against the writer of the article, but he had not done so. Up to the present time the magazine had not been published nor was there any prospect of its ever being published. Feilden had produced a few dummy copies of the proposed magazine, which represented a week's work and a cost of 10s. per copy. Petitioner believed that if the whole of the remaining capital were subscribed it would be totally inadequate to meet the expense of producing this magazine, and maintaining it for twelve months, until the advertisements began to pay, and Theodore Feilden, with his experience as a printer and of journalism, must have been fully aware of this at the time the company went to allotment. If the magazine were published an outlay of from £400 to £500 per month would be required for twelve months to successfully establish the undertaking, and no return from the advertisements, on which the success of the magazine depended, could be expected during that period. The amount available for calls upon shares was £2,404, and the number of shares remaining unallotted was 3,146, making a possible available capital of £5,550, to meet an estimated expenditure of £6,000. Owing to the delay in the publication of the magazine many firms which had promised petitioner to advertise in the magazine had withdrawn their support. The dissatisfaction of the shareholders with the conduct of the undertaking was so great, and the undertaking had been so unfavourably criticised in the Press and among electrical people, that it was unlikely that any more shares would be taken up by the public. The only asset of the company was the bare copyright in the name, the office furniture, the cash now remaining in the bank, and a few contracts for advertisements, which were liable to be cancelled on the ground of the long delay in the publication of the magazine. Proceeding, Counsel submitted that the company was being carried on solely in the interests of Feilden, and the petitioner submitted that it should be wound up.

Replying to questions by his Lordship, Mr. Astbury said his client held 100 shares, and he was supported by 27 shareholders holding 541 shares. The total number of shareholders was 154.

Mr. Hart, who opposed the petition, said he appeared for 58 shareholders holding 3,613 shares paid for in cash.

Mr. Astbury: My client states that they only hold 2,000 odd shares. I am told they have not given notice.

Mr. Hart said practically all had given notice.

Mr. Buckmaster, K.C., who appeared for the company, said further notices had been received that morning representing 160 shares. The petitioner had circularised the shareholders, and had received no more support than that stated.

Mr. Astbury said the opposing shareholders seemed also to have sent out circulars.

His Lordship: Assuming Mr. Feilden was to blame in every respect, I don't say he is for a moment, but let us discuss the matter on the footing that he has got 6,500 shares. If a meeting were held of shareholders and a vote taken on the question of whether there should be a voluntary winding up, of course the petitioner would be defeated.

Mr. Astbury: It would be hopeless.

His Lordship: You are a small minority of the shareholders, and the majority want the thing to go on. How can I therefore wind it up?

Mr. Astbury: That is the difficulty. If I went into a lot of details, I could show a good many things about this company which are unsatisfactory. As your Lordship takes the view expressed, I don't think I should waste the time of the Court.

His Lordship: I dismiss the petition with costs.

Mr. Buckmaster, K.C.: It may please my friend to know that the first number is ready for him.

Lloyd's Packing Warehouses, Ltd., *v.* Veritys, Ltd.

On Friday and Saturday last this case came before Mr. Justice Jelf at the Manchester Assizes. From the *Manchester Guardian* we gather that it was an action to recover damages for breach of contract. Plaintiffs, who have a large packing business at Manchester, established sawmills in Castlefield for making their own cases, and the defendants contracted to supply electrical machinery and gas plant for driving the same. The cause of action arose out of the alleged incapacity of this machinery, when brought into use, for the work which, it was alleged, the defendants had contracted it should do.

Evidence was called to prove an undertaking on the part of the defendants that the plant should accomplish all that was required by the plaintiffs. On the other hand, the defendants endeavoured to show, in cross-examination, that the failure was due to excessive loads, and that no opportunity was given for tests being made as to whether the machinery would do the work specifically mentioned in their undertaking by the defendants.

Evidence for the plaintiffs had not been concluded when it was arranged that the further hearing should be adjourned *sine die*. Application will be made to the learned Judge at Liverpool as to the continuance.

Postmaster-General *v.* Wimbledon U.D.C.

On Friday last at the Kingston-on-Thames County Court application was made on behalf of the Postmaster-General for permission to erect telephone-poles and wires in certain parts of the Wimbledon district. The P.M.G. had applied to the Urban District Council for its consent, but this had been refused, the Council standing out for underground wires in some places and ornamental poles in others. When the matter came before the Court last Friday the Council renewed its objections. The application of the Postmaster-General was, however, granted.

Metropolitan Electric Supply Co., Ltd., *v.* Lundy and Wheatley.

Mr. Justice Lawrance, in the King's Bench Division of the High Court on Wednesday (25th), tried an action brought by the Metropolitan Electric Supply Co., Ltd., against Mr. Harry Lundy and Mr. M. L. Wheatley, the managing director and chairman of the Royal, Ltd., to recover £68 17s. 2d. under a guarantee. It appeared that the Royal, Ltd., owned and ran the "Royal Music Hall."

After hearing counsel's statements, and evidence, his Lordship gave judgment for the plaintiffs with costs.

Knight *v.* The Isle of Wight Electric Light and Power Co.

In the Chancery Division of the High Court of Justice on Wednesday (November 25th) the trial of this action came before Mr. Justice Joyce. Plaintiff, Ada Emily Knight, claimed an injunction to restrain the defendants from so working their engines, and so carrying on their works at Ryde, in the Isle of Wight, as to interfere with the enjoyment of certain premises known as St. Boniface College, occupied by the plaintiff, as a high-class school, or so as to cause annoyance and danger to her, or the persons inhabiting or frequenting the premises. Damages and costs were also asked for. The lease under which the plaintiff held the premises was for 21 years from 1900 at £250 a year. A clause in the Corporation's electric lighting order provided that nothing in the order should exonerate the undertakers from any indictment, action, or other proceeding for nuisance in the event of nuisance being caused or permitted by them. In the early part of the present year the defendants acquired a piece of land adjoining the plaintiff's premises on the east side, and purporting to act under the authority of the order, erected on it extensive works for the supply of electric light and power, and for the manufacture of water-gas in connection with it. The defendants' works were 65 yds. distant from the plaintiff's dwelling house. The defendants commenced to work the engines and machinery about September 10th last, and immediately thereafter serious vibration was, and still is, felt at the plaintiff's premises whereby the doors and windows of the house were made continually to rattle. Loud and disagreeable noises were caused by the defendants' machinery, which were distinctly audible in the plaintiff's premises, and the noise and vibration had continued on occasions throughout the night in such a way as to seriously interfere with the proper rest and repose of the plaintiff and the inmates of her house. The defendants also caused or permitted objectionable and offensive smells of great intensity to be emitted from their works and to come upon the plaintiff's premises. The defendants' acts had seriously interfered with the enjoyment of the plaintiff's premises, and they threatened to continue them unless restrained by the Court.

The defendants said that the Corporation of Ryde, being under a statutory obligation to supply electricity for public and private purposes within the Borough of Ryde, recently contracted with the defendants for the erection, maintaining and working by the defendants of the generating station, and the site of the defendants' works and plans were submitted and approved by the Corporation. These works were not in actual operation until October 1st, 1903. In September some necessary experimental and preliminary operations were conducted at the works for the purpose of testing the engines and apparatus, and for the purpose of charging the electrical accumulators. During these operations some noise, and possibly escape of gas, were unavoidably caused by the working of the new machinery, but the necessity and the cause of the same were explained to the plaintiff, and remedied as soon as practicable before the commencement of the action, and no injury or damage was caused to the plaintiff. The defendants' works were of the most modern character, the electricity being supplied on behalf of the Ryde Corporation for a number of public and private installations in Ryde. Since September 20th the defendants' engines had never been running or working later than 11 o'clock or earlier than 8 a.m. The defendants did not admit that vibration had been felt on the plaintiff's premises, owing to their works, or that there was such noise as to interfere with the enjoyment of the plaintiff's premises. They denied that they had caused or permitted offensive smells to be emitted from their works, and said none were emitted, and that the enjoyment of the plaintiff's premises was not interfered with.

(*To be continued.*)

BUSINESS NOTES.

Hands, Ltd.—Mr. G. S. Barnes, the senior Official Receiver and liquidator of this company, is applying to the Board of Trade for his release, and he has issued a summary of his receipts and payments up to date. The directors had estimated that the assets would produce a surplus of £2,516 available for the unsecured creditors, whose claims amounted to £6,736. But the net result of the realisation to date is such as to leave nothing for the unsecured creditors as only £7,700, or thereabouts, is available for payment to the Law Guarantee and Trust Society, Ltd., on account of the debenture debt of £10,000 and arrears of interest. The book debts, which were estimated to produce £9,732, only produced £7,296, a deficiency of £2,436; other assets were estimated to bring in £15,922, but at the sale conducted by Messrs. Fuller, Horsey & Co. they only produced £4,160, a deficiency of £11,762. The difference between the book value and the amount actually realised is thus a deficiency of £14,198.

Glasgow Telephones.—We have received from the publishers of the *Manchester Courier*, a small pamphlet which they have lately issued respecting the Glasgow Corporation telephone department. A synopsis of the accounts and balance-sheet for last year is given, and the importance of allowing adequately for depreciation is pointed out. The object of the pamphlet is to educate local opinion in the Manchester area so as to prevent the error of municipal telephony being repeated there.

Engine Contracts.—Messrs. Browett, Lindley & Co., Ltd., have received an order for one 50-H.P. engine from Messrs. J. P. Hall & Co., Oldham, for the Soudan Mill Co., Ltd., Middleton; also for one 300-B.H.P. engine from Messrs. Mather & Platt, Ltd., of Salford, for Messrs. R. Evans & Co., Haydock Collieries, St. Helens.

Transvaal.—According to returns just issued, the value of the electric cables, wires and fittings imported into the Transvaal during the eight months ending with August last reached a total of £49,000, as compared with only £25,000 in the corresponding eight months of 1902.

Gilbert Arc Lamps.—We understand that the Gilbert Arc Lamp Co., Ltd., have been called upon to replace the lamps (of another make) installed in Nuneaton with their 6-ft. carbon lamp, burning 30 to 40 hours with yellow-flame carbons, or 60 to 80 with ordinary carbons. The work had become very urgent, and was carried out, including the scheming and alteration of the necessary arrangements in the post bases, in a fortnight. They have since been called upon to execute similar work in another important installation.

Electrical Wares Exported.

Week ending Nov. 25th, 1902.	Value £
Adelaide	130
Amsterdam	169
Auckland	816
Bangkok	62
Bombay	311
Buenos Ayres. Teleg. mat.	184
" Teleph. mat.	1,487
Calcutta	5,731
Cape Town	588
Copenhagen. Teleg. mat.	208
Durban	1,151
" Teleg. mat.	341
East London	277
Fremantle	130
" Teleg. wire	128
Gibraltar	53
Hamburg	9
" Teleg. mat.	750
Hobart	43
Hong Hong	40
Karachi	278
La Plata	23
" Teleg. mat.	73
Madras	25
Melbourne	905
Nagasaki	418
Odessa	42
Ostend	160
Penang	11
Perth	17
Piraeus	25
Port Elizabeth	550
Shanghai	161
Singapore	76
Stockholm	18
Sydney	642
Tokio. Teleg. mat.	1,690
Toronto	63
Wellington	216
Yokohama	66
" Teleg. mat.	274
okosuka	268
Total	£18,189

Week ending Nov. 24th, 1903.	Value £
Adelaide	665
Aden. Teleg. mat.	60
Alexandria	85
Amsterdam	100
Beira. Teleg. mat.	252
Bombay	70
Buenos Ayres	54
" Teleg. cable	1,541
Calcutta	512
Cape Town	1,205
Carlskrona. Teleg. cable	128
Colombo	175
Delagoa Bay	178
" Teleg. mat.	5,844
Durban	1,559
Gibraltar	86
Halifax. Teleg. mat.	60
Hong Kong	348
Lisbon. Elec. cable	47
" Teleph. mat.	112
Madras	16
Melbourne	339
Ostend	56
Otago	90
Paris	14
Port Elizabeth	119
Rodriquez. Teleg. mat.	70
Rosario	57
Shanghai	55
Singapore	199
Sydney	884
" Teleg. mat.	220
" Teleph. cable	840
Wellington	43
" Electrical cars	5,050
Zanzibar	578
Total	£21,091

Foreign Goods Transhipped.

	Value £
Genoa. Elec. goods	20
Hamburg. Elec. machinery	80
Melbourne. Elec. goods	54
Sydney. Elec. goods	190
Total	£344

Books Received.—"Report of the Influence of Gauge Length and Test Bar on the Percentage of Elongation," by Prof. W. C. Unwin. Publication of the Engineering Standards Committee. London: Crosby Lockwood & Son. 2s. 6d. net.

"The Physical Society of London, Proceedings:" Vol. 18, Part 6. London: Taylor & Francis.

"Controle des Installations Electriques," by A. Monmerqué. Paris: Ch. Béranger & Co. 1904. Fr. 15.

"Fire Tests with Doors," No. 76; and "Fire Tests with Floors," No. 79. London: The British Fire Prevention Committee. 2s. 6d. each.

"Friction and its Reduction," by G. U. Wheeler. London: Whittaker & Co. 3s. net.

"Directory and Map of Automobile Charging Stations." London: *Electrical Times* Office. Leather 3s. 6d.; cloth 2s., net.

Dissolutions and Liquidations.—Creditors of the Electric Tramways Trust, Ltd., must send particulars of their debts, &c., to Mr. L. Morse, 32, Queen Victoria Street, E.C., or Mr. R. A. Goodman, Granville House, Arundel Street, W.C., the liquidators, by January 1st, 1904.

A meeting of the Prism Globe Syndicate will be held at 60, King Street, Manchester, on December 29th, to hear an account of the liquidation by Mr. J. H. Bardsley, the liquidator.

For Sale.—Messrs. Weatherell & Green will, on November 30th and December 1st, offer the premises, plant, and stock of the Renewable Electric Lamp Co. for sale by auction. Particulars may be found among our advertisements to-day.

"Simplex" Conduits.—We understand that conduits and fittings other than those manufactured by the Simplex Steel Conduit Co., Ltd., have been supplied by other firms as "Simplex" material. A notice respecting the matter appears among our advertisements to-day.

New Ampere and Voltmeter.—The illustration shows a new combined portable, precision (moving-coil) type of ampere and voltmeter that has been put on the market by the Union Electric Co., Ltd., of Queen Victoria Street, E.C., to enable installation firms and private users to have a reliable test instrument, permitting them to correctly instal the electrical apparatus of considerable range in sizes. The instrument consists of two moving coil instruments surrounded by a stout polished oak case, in the lower part of which is a 6-cell battery. The apparatus may either stand up, as shown in the illustration, or work lying upon its back.

The voltmeter scale can be put to the following uses, and it is divided into 75 equal divisions:—(*a*) Voltmeter readings, (1) From 0 to 3 volts for primary and secondary batteries very low voltages; (2) From 0 to 150 volts for private plants and battery installations; (3) From 0 to 600 volts for central station light and power supply mains. (*b*) Ohmmeter readings:—(1) Using the 6-cell battery, insulation up to 500,000 ohms may be measured; (2) Using no line voltages and the other terminals of the instrument, but insulation resistance of life circuits may be determined by using a simple mathematical formula.

The amperemeter scale is divided into 60 equal divisions, and may be used (*a*) Ampere readings:—(1) The instrument being of the shunt type, may be used with a number of shunts, say, for instance, one shunt from 0 to 30 amperes, and another shunt from 0 to 150 amperes; (2) Millivolt readings, by putting the instrument in the direct circuit of low voltages, voltages as low as $\frac{1}{1000}$ of a volt may be measured. The whole apparatus weighs 9 lbs.

Catalogues and Lists.—Messrs. Beanland, Perkin and Co., of School Close Works, Leeds, have brought out an illustrated catalogue showing several of their latest patterns of hack saw. One is the No. 4B saw as used by the Leeds Corporation tramway repairing shops, this particular illustration showing the operation of sawing through the steel tire of a tram-wheel. Other machines described in the list include portable rail saws, track drills, and portable electric hack saw for shipyard and other work.

The Electrical Co., Ltd., has placed before us a booklet (32 pp.) in which particulars respecting the Luna arc lamps and their installation are given, together with many neat illustrations showing interior and exterior views, giving prices, and so on.

The American Electrical Novelty & Manufacturing Co., Ltd., of Charing Cross Road, has issued a catalogue in which it gives small pictures and notes prices and principal details of the "Ever-Ready" electric specialities, such as night lights, reading lamps, vehicle lamps, electric candles, &c.

A new illustrated circular relating to their inverted differential arc lamps and arc lamp accessories, including cut-outs, elevators, resistances, transformers, and choking coils, has been brought out by Messrs. Smithson, Sharpe & Co., of Sykes Street, Hulme, Manchester.

Messrs. Falk, Stadelmann & Co., Ltd., of Farringdon Road, E.C., are placing upon the market a new electrical heater, which is claimed to be very economical as regards energy consumption. The heaters—known as the "Phœnix" patent—form the subject of an illustrated price list just issued by the firm. Some neat designs are shown therein.

Messrs. Siemens Bros. & Co. have just issued a pamphlet (No. 1A) in which, in the course of some 66 pages of enamelled art paper, are given many illustrations and full descriptive letterpress relating to their electrical crane and capstan equipments. The mechanical construction load factors, outputs, and other electrical data, respecting their crane and capstan motors, particulars of their lift motors, crane controllers, switchboards, connecting-boxes, brakes, and so on, are followed by numerous useful tables and curves respecting outputs and dimensions, diagrams of connections, and so on. The pictures include views of cranes supplied to the Bengal-Nagpur Railway Co., Natal Government railways, Japanese Government, the North-Eastern Railway Co.'s docks at Middlesbro', and for the Admiralty Pier, Dover.

The Clift Manufacturing Co, of Bravington Road Works, Harrow Road, W., have sent us a set of sheets showing illustrations of some of their main switchboard work, accumulator board, house service fuses, H.V. spring clip fuseboards, knife switches, snap-off switches, &c.

The Societe D'Appareillage Electrique et Industriel Gardy Freres & Cie., of Geneva, have sent us several lists relating to their different lines of electrical apparatus and accessories, including insulators, fittings, and lamps for electric street lighting, electric lighting casing, wires and cables, switches, fuses, ceiling roses, and a multitude of other details.

Messrs. Mosses & Mitchell, of Chiswell Street, E.C., have issued some lists respecting their "Tuffarine" gray valves for air and circulating pumps, which are claimed to be very durable.

From Messrs. Seidel & Naumann, of 23, Moor Lane, E.C., we have received a circular respecting their self-lubricating metallic packing rings, which are being used by some of the leading English engine makers. The Corporation electrical engineer at Sutton Coldfield says that, though the engines ran at a speed of 350 revolutions with steam superheated to 550° F., no difficulty was experienced in keeping the glands steam-tight and the piston rod well lubricated.

Electrical News from Japan.—The German Consul at Kobe, Japan, sends an interesting report to his Government on the subject of electrical industry in Japan, in the course of which he states that the Japanese have not yet succeeded in constructing electrical dynamos and motors that can hope to compete with European and American machines. Their efforts in the manufacture of incandescent lamps and cables have been more successful, but they are not yet able to supply their own needs. On the other hand, for the last few years Japan has manufactured porcelain insulators of an excellent quality and at a price so low as not to fear foreign competition. Several important projects for electrical installations are at present under study; the construction of an electric tramway between Kobe and Hiogo, an electric tramway at Osaka, an electric railway between Kobe and Osaka (30 kilometres), and several other lines in the interior of country. The utilisation of latent energy of Lake Biwa for the working of a powerful electric station to be built near Omi is also under consideration. More than half the electrical machinery imported into Japan comes at present from the United States. Amongst the other importing countries Germany and England dispute the second place. To push the sale of German electrical products in the country the Consul recommends, amongst other means, the publication of an illustrated catalogue in Japanese, and the creation in one of the large towns of a permanent exhibition of specimens sufficiently stocked for the immediate sale of small supplies for current use. A technician should be placed at the head of such a museum to study commercial practice, and, naturally, the language of the country.

Bankruptcy Proceedings.—In connection with the public examination of F. Fanta, to which we referred last week, we understand that the chief assets disclosed in the statement of affairs are as follows:—

500 shares of £1 each (fully paid) in the Electric Lamp Regenerating Co., Ltd. (in liquidation) valued at	£25 0 0
1,500 shares of £1 each (fully paid) in the Electric Glow Lamp Co., Ltd., valued at	375 0 0
100 shares of £1 each (fully paid) in Mercier, Ltd., valued at ..	Nil.
One-third share of 10,000 shares to be allotted on the sale of the British rights of the patent processes for cleaning and renewing electric lamps, estimated to produce	1,666 10 0
Two-fifths share of the profit to be derived from the sale of the foreign rights of these processes, estimated to produce..	1,500 0 0
Interest in £500 in cash and 1,000 shares to be paid and allotted on the sale of the patents for the automatic advertising machine to a company, estimated to produce ..	1,000 0 0
	£4,566 10 0

In the opinion of the Official Receiver, the realisable value of most of those assets must be regarded at present as doubtful.

At Bristol County Court on Friday, Frederick King, electrical engineer, of Stone Bridge, applied for his discharge from bankruptcy. It was reported that the greater portion of the liabilities were in respect of the debtor's indebtedness to a former partner. The discharge was suspended for two years.

The first meeting and public examination in *re* George Neale, Fulham Palace Road, are arranged for December 4th and January 15th respectively, at Carey Street.

The Secretary of the South-Western Electrical Co., Ltd., of Fulham, writes to us as follows:—

> With reference to the bankruptcy proceedings against Mr. George Neale (lately trading with Mr. J. Carnaby as the South-Western Electrical Contracting and Maintenance Co.), I beg to state that such proceedings are in no way connected with this company, and trust you will insert this letter in your next issue.

A second and final dividend of 10s. in the £ (making a total of 20s.) is payable on December 2nd in *re* J. F. Worthington, electrical engineer, of Hanley.

Trade Announcements.—Among the new electrical companies recently established on the Continent is one to be known as W. F. Jones & Co., of Forest, Brussels. The principals of the concern are Mr. W. F. Jones, of 77, Rue Maghin, Liège; Mr. Donald G. Macmillan, of Glasgow; and Mr. G. J. Neybergh, of Brussels. The object of the company is primarily to manufacture switches and switchboards, but particularly controllers and starting switches, in the design of which Mr. Jones is a recognised expert. He will be known to our readers as having been associated with the late Mr. Slater Lewis in starting the electrical department of Messrs. P. R. Jackson & Co., and also as manager and engineer of the Electric Transmission Co., of Hammersmith. Mr. Jones has latterly had charge of the switchboard and apparatus department of the Compagnie Internationale d'Eléctricité, Liège, and amongst other work introduced motor-starting switches and controllers on English lines to the Continental trade. Mr. Neybergh obtained his commercial experience in this country, and he has for many years had charge at Liège of the commercial side of the extensive English business of the Compagnie Internationale d'Eléctricité. Mr. Macmillan was outside erecting engineer to the same company.

Messrs. Braby & Tomlinson, Ltd., of Hart Street, Bloomsbury, and Baltic Street, E.C., electrical engineers and contractors, and proprietors of the contracting business of Messrs. Pritchetts & Gold, have disposed of the business to Messrs. Duncan Watson & Co., who take over the goodwill, stock-in-trade, lease, work in hand, and the books and papers of the company. The transfer takes place as from the 26th inst. The only reason for disposing of the business is the retirement of Mr. Braby to take up a position with the well-known firm of Messrs. F. Braby & Co. All communications should be addressed to 100, Charing Cross Road, W.C.

Mr. Wm. Fowler Barnaby, electrical engineer, has relinquished his position as manager of Messrs. Barnaby & Co., Ltd., electrical engineers, of 13, College Street, Rotherham, and has commenced business on his own account at 16, Lindum Terrace, Doncaster Road, Rotherham.

Mr. A. Higgins and Mr. S. Griffiths have entered into partnership to carry on the business of electrical engineers and contractors, at 4, Albany Street, Regent's Park, N.W., under the name of Higgins & Griffiths.

The business of the B. & S. Folding Gate Co., originally started for the manufacture and sale of the B. & S. patent folding gates, has increased to such an extent, and other productions form so large a proportion of the business, that the title "The B. & S. Folding Gate Co." is now a misnomer, and the cause of misunderstanding. We are asked to state, therefore, that in the future the business will be conducted under the personal name of Arthur L. Gibson & Co.

Mr. Isidor Frankenburg, of Isidor Frankenburg, Ltd., announces that as his sons are taking a great interest in the management of the business, and are large shareholders, he has decided to identify them with the name of the company. This has accordingly been altered to I. Frankenburg & Sons, Ltd. The alteration involves no change in the directorate or management of the business, and the shares will continue to be in the hands of Mr. Frankenburg and his family, and some of the principal employés.

Imports of Foreign Electric Apparatus.—There was again a large increase last month in the imports into this country of foreign electrical goods and apparatus, the returns showing a total of £63,661, which compares with only £51,139 in October last year. So far as the year has gone—that is to say, during the ten months ending with October last—these imports have obtained an aggregate value of £649,144, as contrasted with only £556,394 in the corresponding ten months of 1902.

The National Cycle and Motor-Car Exhibition.—At the annual National Cycle and Motor-Car Exhibition there is not a single electrical vehicle to be found among the many motor-cars on view, nor even one of the combination petrol-electric class, of which much has been, and still is, expected. There are, on the other hand, quite a number of firms showing small accumulators, coils, and other accessories required in connection with the ignition in petrol motors. In this branch Messrs. J. Lacoste & Co., of 176A, Shaftesbury Avenue, W.C., have a large display in the way of contact-breakers and coils. Among the former is an ingenious wipe contact-breaker for use on the engines of motor-cycles. The contact is made at the firing point between a steel roller and a tempered steel block let into a fibre ring, the whole being enclosed in a dustproof and oil containing casing of gun-metal. Another novelty is an ignition controller for use on multi-cylinder engines. Usually, in the case of ignition troubles or "missing," it is not an easy matter to tell which cylinder is not working properly, but by means of the new device, which is arranged in the circuit, each cylinder may be separately tested. The Lithanode type of accumulator has now been adapted to ignition purposes, and a display of this type is made by Messrs. Longstreth's, Ltd., 427A, Strand, W.C. As is well known, the positive plate of this accumulator is built up of a special solid material cast up into lead sections, which, it is claimed, enables these batteries to be discharged at exceptionally high rates, and the elements are not injured by short-circuiting. For use on motor-cycles where vibration is somewhat excessive, a special non-spillable accumulator has been introduced. To attain this object, the celluloid cell is made larger than usual, so that an auxiliary sealed cell may be formed at the side, into which any acid which may be shaken out of the accumulator, owing to vibration, finds its way, instead of being sprayed on to parts of the machine; another advantage of the arrangement is that it greatly facilitates the handling of the accumulators, the acid being unspillable in any position. On Messrs. Longstreth's stand we were able to examine several of the induction coils for ignition purposes which are now being made by Marconi's Wireless Telegraph Co., Ltd. These are made in various forms for one, two, three and four-cylinder engines, and to work at speeds up to 4,000 revolutions per minute. The coil for high-speed work is fitted with a special trembler in which, instead of screw and spring contacts, each contact is fixed at the end of a flat spring. The upper one is so adjusted that when the circuit is closed the break is slightly retarded, thus allowing the core to be more fully magnetised. Messrs. H. W. Cocks & Co., of 143, Kew Road, Richmond, confine their exhibit to a range of 4-volt accumulators in sizes from 4 to 60 ampere-hour capacity, suitable for use on petrol motor-cars and cycles. They are made in celluloid, ebonite or polished wood cases. The plates are well raised from the bottom of the cell and are provided with non-short-circuiting separators. Coils, accumulators and other ignition accessories are also shown by the Woodcote Engineering and Motor Works, of Wallington, Surrey; the Lee Motor-Car Supply Co., 9, Hills Place, Oxford Circus, W.; Messrs. L. Rene & Co., 6, Snow Hill, E.C., and Messrs. Chas. Peacock & Co., 35, Clerkenwell Road, E.C.

ELECTRIC LIGHT AND POWER NOTES.

Abercarn.—The U.D.C. has decided to apply to the B. of T. for a prov. order for electric lighting.

Acton.—The U.D.C. has resolved to appoint Mr. W. H. Trentham at a fee of £10 to advise as to the lighting of its area by electricity. During the discussion it was stated that certain members of the Council had received hams, and that upon communicating with the packers at Limerick, from which place the hams were received, it was found that one of the unsuccessful applicants was the sender. The Council referred to the desirability of having a combined lighting and destructor works, and the L.G.B. has already sanctioned a site for the latter at Bedford Park. The expenditure involved is estimated at £100,000.

Alloa, N.B.—The T.C. has resolved to do away with the electric arc lamps for street lighting and to instal high-pressure incandescent gas lamps of 500 C.P. each in their place. The Council has come to the conclusion, after experiments, that it is too costly to continue to run the arc lamps any longer. The price of gas is 2s. 2d. per 1,000 cb. ft.

Andover.—The Southern District Electricity Corporation has notified the T.C. that it intends to apply to the B. of T. for a prov. order to supply electricity within the borough.

Aylesbury.—The prov. order for electric lighting obtained by the T.C., to which the B. of T. granted an extension of time, has lapsed, and cost the ratepayers about £300.

Barnes.—The T.C. has asked permission from the L.G.B. to borrow £4,500 for extension of mains.

Bedwellty.—The U.D.C. is negotiating with the Powell Duffryn Coal Co. for a supply of energy for lighting purposes.

Bengal.—The wealthy Zemindars and Maharajahs are using electricity very largely for the lighting of their palaces. We hear of a gigantic electrolier just procured from a Calcutta firm at a cost of Rs. 10,000 for the Maharajah of Dharbanga's new palace at Rajnagar.—*Indian Engineering.*

Birkenhead.—The Corporation will shortly make application to the B. of T. to extend the area of supply, by including the districts of Prenton and Upton.

Brentwood.—The U.D.C. has decided to apply for a prov. order to supply electricity within the town and in the parishes of Great Warley, South Weald, Little Warley and Shenfield.

Brierley Hill.—A two years' extension of time in which to carry out the E.L. order has been applied for by the U.D.C.

Caerphilly.—The canvass on the E.L. question having proved satisfactory, the U.D.C. has decided to apply for a prov. order.

Cheshire.—The Cheshire Electrical and Power Gas Syndicate has been formed to obtain Parliamentary powers for carrying out an undertaking for the county. It is proposed to raise a capital of £1,000,000. The scheme provides for electrical generating stations to be located at Newton, Middlewich, Frodsham, Timperley, Bollington and Dukinfield. It is also proposed to take over as a going concern the Northwich Electrical Supply Co., an undertaking which is in active operation and earning a dividend. The area of supply covered by the syndicate's scheme is 654,825 square miles, and it has a population of over 827,000, chiefly industrial and mining, so that the demand for electric energy and power gas ought to be considerable. Electricity both for lighting and power will be placed within the reach of the more remote towns and villages which have already obtained provisional orders, or may contemplate doing so, independent stations for the several localities being unnecessary. By an arrangement with the Power Gas Corporation, Ltd., Mond gas will be supplied throughout the whole area.

Chesterfield.—A L.G.B. inquiry has been held into the application of the T.C. for a loan of £15,000 for electric light and power supply purposes. There was no opposition.

Clydebank.—The T.C. has completed an agreement with the Clyde Valley Electric Power Co. for the taking over of its prov. order for supplying energy within the burgh.

Croydon.—The R.D.C. on 19th inst. decided to apply to the B. of T. for a prov. order to supply electricity to the parishes of Beddington, Coulsdon and Sanderstead.

North-Western Electricity and Power Gas Co.—Last session Parliamentary powers were obtained by this company to provide works for the supply of a large district covering parts of Flintshire, Denbighshire, Derbyshire and North Staffordshire, but excluding Cheshire. The promoters will go to Parliament next session for a revision of the original scheme of power stations. It is now proposed to establish eight stations—one in Flintshire, one in Derbyshire, one in or near Wrexham, and five in Staffordshire.

Dunfermline.—The T.C. has unanimously agreed to oppose the National Electric Construction Co.'s application for a prov. order to supply the burgh with electricity.

The T.C. has received notice of a scheme for the lighting of its district from the Fife Electric Power Co., which is expected to be of great service to the burgh.

Eastleigh and Bishopstoke.—The U.D.C. on November 19th decided to apply for a prov. order for E.L.

Edmonton.—Objection has been raised by a deputation from the local Traders' and Ratepayers' Defence Association to payments amounting to £1,124 being made by the D.C. to solicitors, Parliamentary agents, and electrical experts in connection with the proposed introduction of electric lighting into the district, on the ground that the Council had no mandate from the ratepayers to incur the expense.

Exeter.—The mayor on the 16th inst. inaugurated the new electricity works at the Basin, but it is not expected that the undertaking will be completed for some months hence. The plant consists of three sets of 550 H.P. each and one of 150 H.P.

Frinton-on-Sea.—The E.L. installation carried out by the Frinton and District Electric Light and Power Co. was inaugurated recently by Col. R. P. Davis.

Germany.—The establishment of a municipal central electric lighting station in the town of Neisse, at an estimated cost of £16,500, has been decided upon.

Glasgow.—The electrical engineer in a recent report to a sub-committee of the T.C. as to the extension of plant required at Port Dundas and Pollokshaws Road generating stations, stated that it would be necessary to increase the generating plant at the former by some 6,000 KW., and at the latter by 1,500 KW.; he did not think it safe to take a further supply of energy from the tramways department. As regards the type of plant that should be adopted for the extensions, whether steam engines, gas engines or steam turbines, he had come to the conclusion that although gas engines worked by producer gas were likely to prove in the near future the most economical in fuel consumption, they would be considerably more expensive in capital cost. In the case of Port Dundas station he recommended steam turbines, and for Pollokshaws Road works high speed reciprocating engines with alternative estimates for gas engine plant. The cost of the extensions, including additional buildings at Port Dundas, cables to sub-stations, &c., is estimated at £135,000. The committee, after consideration, decided to proceed with the extension of the generating station buildings at Port Dundas, but adjourned consideration as to the additional plant for both stations. The sub-committee was empowered to appoint a deputation of its members to visit any English town where turbine plant had already been adopted for generating energy for the purpose of inspecting the same and making inquiries.

The total amount borrowed for electric lighting purposes now amounts to £1,142,000.

Guildford.—The Highway Committee states that it is unable to accede to the application of the Guildford Electricity Supply Co. for permission to erect a line of poles with overhead wires along the main road, to supply electricity to Merrow.

Ham (Surrey).—The U.D.C. has practically come to an agreement with the Twickenham and Teddington Electric Supply Co. relative to the supply of energy to the district. The company is willing to undertake the public lighting at a rate not exceeding 2d. per unit, and to supply private consumers at 6d. per unit for the first hour per day, and 3d. per unit afterwards, on the maximum demand system. The company will receive no opposition from the Council, which is to have the right of purchasing the undertaking at a valuation as a going concern at the end of 7, 14 or 21 years.

Heligoland.—The lighthouse on this island has been equipped with electric light. There are three parabolic lenses, which revolve four times a minute, throwing out three independent beams visible at a distance of 20 miles on the surface of the water. It is stated that the light is one of the most powerful now in use.

Horley.—A syndicate is applying for a prov. order for electric lighting in the district. The Council will support the application.

Hull.—It is proposed, as an experiment, to work the Salthouse Lane Bridge across the River Hull by electricity.

Ilfracombe.—The E.L. works established by Edmundson's Corporation has been formally opened by Mr. H. A. Palmer, J.P., chairman of the Council.

Ipswich.—The T.C. has fixed the following scale of charges for energy:—Lighting, 6d. per B. of T. unit, with a rebate of 1 per cent. for every 50 units consumed per quarter up to 800 units, and 1 per cent. for every 100 units above 800 until the minimum charge of 4d. is reached. Power, heating and cooking, 2d. per unit with a rebate of 1 per cent. for every 500 units per quarter up to a total of 12,500 units, and after that a rebate of 25 per cent.

Italy.—Application has been made for sanction to obtain power from Lake Bormida di Malare and the Bormida di Pillare Torrents for the generation of electric energy. It is estimated that 9,800 H.P. will be required, and it is intended to supply energy to works, &c., between Savona and Genoa. The cost of the undertaking will be about 4,400,000 lire.

A concession has been granted to the Società Co-operativa per l'Illuminazione Elettrica di Valli dei Signori to put down a plant to utilise the water power of the River Leogra in the generation of electrical energy.

Johnstone.—The Clyde Valley Electric Power Co. intends to apply for Parliamentary powers to supply electricity for lighting and power in the burgh.

King's Lynn.—Owing to the gas company forestalling the U.D.C. in the lighting of the parishes of West Lynn and Gaywood, the E.L. Committee's decision to light the districts, which came up for confirmation recently, has been rejected by nine votes to five.

Launceston.—The *Hobart Mercury* for October 10th says that tenders are being called at Launceston for the pipe to convey the water to the turbines to drive the new three-phase alternators which are in course of construction, and which are expected there in the latter part of the year. The transformers which are required have been ordered from England, and are expected to arrive with the new plant. At the last meeting of the City Council tenders for 500 new meters were opened, and referred to the Electric Light Committee.

Lichfield.—The T.C. has resolved to apply to the B. of T. for an amendment of the electric lighting order, 1901, extending the time within which to carry it out, and to extend the area of supply to the parishes of Whittington, Shenstone, Swinfen, Packington, Weeford, Wall, Longdon, Fisherwick, King's Bromley, Farewell, Curborough, Elmhurst, Pipe Hill, Burntwood, Hammerwich, St. Chad, and St. Michael, Lichfield.

Littleborough.—The U.D.C. is considering a proposal from Messrs. Baker, Lees & Co. to lease the electric lighting order.

London.—CITY.—The *Gas World* states that after 14 years' experimenting to decide what form of lighting should be adopted for the side streets, the Corporation has resolved to introduce the incandescent gas system. It was stated that the experiment of lighting the Farringdon Without Ward was quite satisfactory

BATTERSEA.—The B.C. has resolved to expend £550 on mains extensions. The E.L. Committee has recommended the Council to again urge the L.C.C. to promote legislation enabling local authorities to wire consumers' premises.

The L.C.C. has informed the B.C. that it cannot see its way to promote legislation to prohibit the use of overhead wires for E.L. purposes from one supply area to another.

Hackney.—In consequence of the Poor Law Guardians' resolve to instal 400 8-c.p. lamps in their new buildings in the Gainsborough Road, and two firms making large demands, the B.C. has decided on laying a 0·75 feeder, at an estimated cost of £4,500. An 0·1 distributor is to be laid, at an estimated cost of £460, and another, at an estimated cost of £215.

Lothians. — The Lothians Electric Power Co. are about to apply for prov. orders to erect generating stations and supply energy in Edinburgh, Peebles, East Lothian, Haddington and Lanark.

Loughborough.—The General Purposes Committee has advised the T.C. to apply to the L.G.B. for sanction to increase its borrowing powers for electric lighting obtained in 1899 for £25,000 to £30,000, and to proceed with the scheme drawn up by Mr. C. H. Gadsby for the lighting of its area. The price for the supply of energy is fixed at 5d. per unit for lighting, and 2½d. for power, with special terms for large consumers. It is estimated that the cost of the scheme will be £28,408. The plant to be installed comprises two sets of 250 kw. each, and room will be provided for another 100-kw. set when required.

Madras.—Messrs. Marshall, Sons & Co. and Messrs. Crompton & Co. are both investigating the district, with a view to establishing an electric lighting undertaking.

Maryport.—The U.D.C. has decided to carry out the electric lighting order within two years, if the B. of T. will grant an extension of time for that period.

Milan.—The Municipal Council is considering the desirability of taking over the electric lighting and motive power services of the city, and the engineer of the municipal technical office has just completed a report on the project.

Newquay.—The Southern District Electricity Corporation has given notice of its intention to apply to the B. of T. for a prov. order to supply the town with electricity.

Northfleet.—The D.C. has written to the Kent Electric Power Co., Messrs. Fowler & Co., solicitors, Westminster, and the Gravesend Corporation, stating that it would assist, at the expense of the promoters, in promoting a supplemental or new prov. order for the district, providing the undertakers would contribute £250 to cover the costs incurred by it in obtaining the existing order.

Paignton.—The U.D.C. has adopted the proposal of the National Electric Construction Co. for the lighting of the town by electricity. The Council is to find the necessary original outlay, and the company guarantee all payments of interest and sinking fund, the costs of the order and cost of construction. The price for energy for private lighting is to be 5d., and for public lighting 3d. per unit.

Phœnix (Victoria). — The plant and works owned by the Phœnix Electric Lighting Co. have been destroyed by fire.

Ramsgate.—The T.C. on 19th inst. decided to support the Bill of the Ramsgate and District Electric Supply Co., promoted by Edmundson's Electricity Corporation, for powers to supply electricity to the town, provided that £2,000 is deposited with the Council. The Isle of Thanet Electric Tramways and Lighting Co. is seeking similar powers.

Shipley.—The U.D.C. has decided to apply for power to supply electricity within the area of the Baildon D.C.

Spain.—Don Javier Toicoa y Barcaiztegui, has obtained a concession to utilise the water of the River Agustegui at the Oyarzun for generating energy for industrial purposes.

Stoke-upon-Trent.—A L.G.B. inquiry has been held in regard to the T.C.'s application to borrow £30,640 for a combined electric lighting and dust destructor works. There was no opposition.

Stratford-on-Avon.—An extension of the prov. order obtained in 1901 for carrying out the E.L. scheme is being applied for by the T.C.

Stroud.—The R.D.C. has decided to support the application of the Gloucestershire Electric Power Co. for a prov. order to supply electricity within the Council's area and to the parishes of Nailsworth and Dursley.

Swindon.—An Act will be promoted by the T.C. in the next Session of Parliament to empower the Council to extend the area of electricity supply to the parishes of Wroughton, Stratton, St. Margaret, and Rodbourne Cheney; to supply electricity in bulk to neighbouring authorities, and to sell and let out on hire, electric light fittings and motors.

Tamworth.—The T.C. has decided to apply for a prov. order for E.L. within the borough and parts of the rural districts adjoining.

Taplow and Burnham.—The Maidenhead Corporation has resolved to apply for a prov. order for lighting and power in these districts. The prices of energy at Maidenhead are 5d. per unit for lighting, and 3d. for power, and the Corporation states that it would supply those outside its area at ½d. extra per unit for each two-thirds of a mile from Maidenhead Bridge.

Thames Valley.—The Twickenham and Teddington Electricity Supply Co. intends to apply for a prov. order to supply electricity in the parishes of Hampton Wick, Esher, the Dittons, East and West Molesey, Sunbury, Feltham, Hanworth, Ashford, Shepperton, Littleton, and Laleham. The consent of several of the local authorities concerned has been secured.

Warsaw.—The new mill for the manufacture of cotton-hosiery, which is in course of erection, will, it is stated, probably be equipped with electric power.

West Ham.—The T.C. has discussed the terms upon which it would provide the L.C.C. with a stand-by supply of energy for the pumping station at Abbey Mills, and decided that the necessary mains, transformer, meters, switchgear, &c., be fixed and maintained on payment of a sum of £200, the L.C.C. to provide the transformer chamber and to take energy to the minimum value of £85 per annum.

Whickham.—The U.D.C. has decided to apply to the B. of T. for the transfer of its order to the County of Durham Electrical Power Distribution Co., Ltd.

Willesden.—The U.D.C. has considered a draft agreement with the North Metropolitan Electric Supply Co. for the sale and transfer of the Council's generating station in Taylor's Lane, together with the machinery and plant therein. The agreement was approved subject to such alterations as the solicitor and electrical engineer consider necessary in the interests of the Council. A draft agreement with the same company for the supply of electrical energy in bulk to the Council was sent to the Electricity Committee for consideration. The question of erecting a dust destructor was discussed and referred to a special committee, which will also report as to the adoption of motor traction for the removal of dust, cartage of materials, &c.

Wilts.—The Western Electric Distributing Corporation, Ltd., of Westminster, is seeking powers to supply electricity in the parishes of Trowbridge, Melksham and Bradford-on-Avon. The revocation of the Trowbridge E.L. order is also sought.

ELECTRIC TRACTION NOTES.

Berlin Railway Tests.—A Berlin despatch says that the trials on the Zossen and Marienfelde line are now being continued, mainly with a view to ascertaining the load which the trains can draw. According to the latest results attained, a load of 130 tons can be drawn at a speed of 160 kilometres an hour.

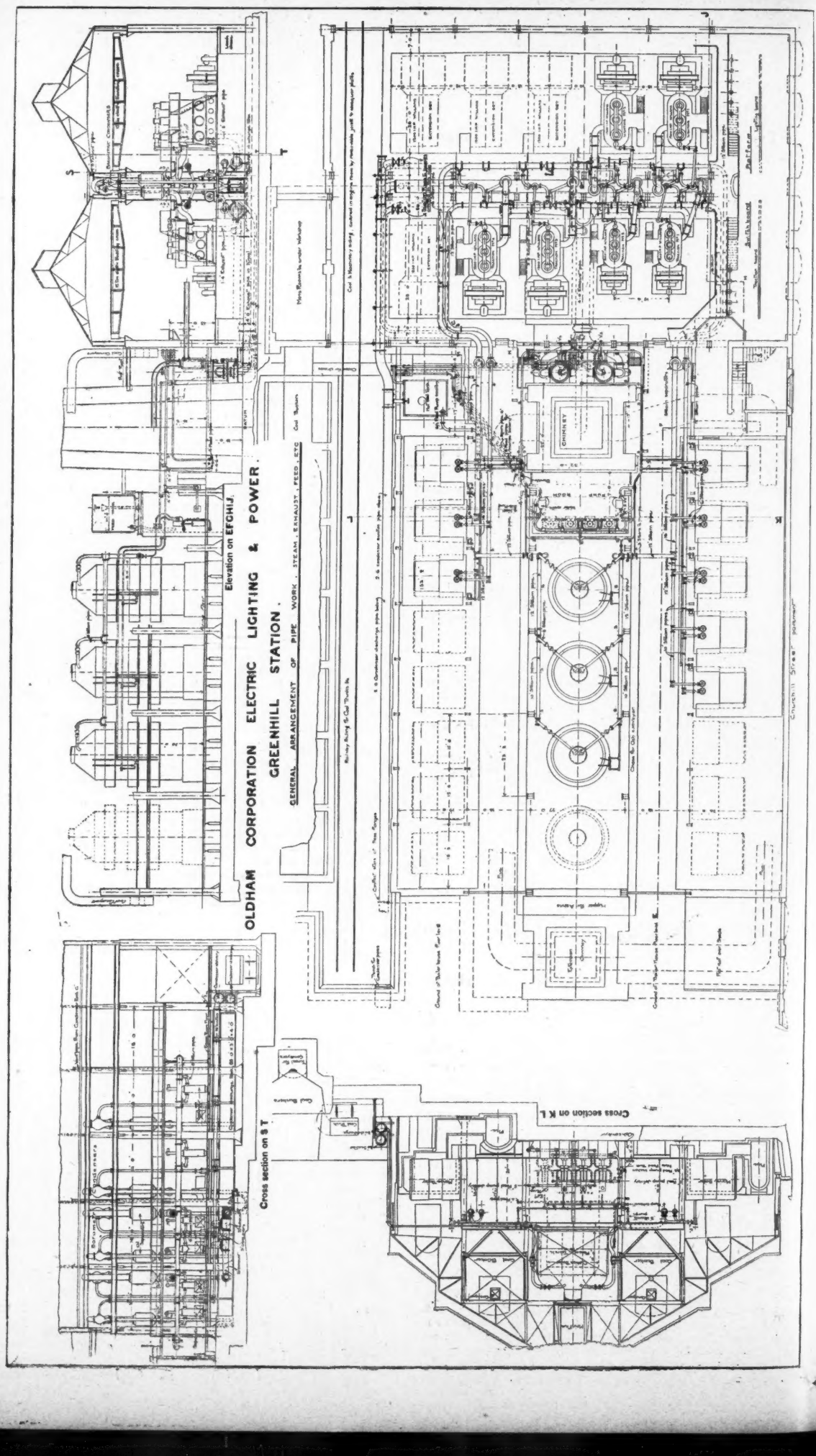
East Cheshire.—Application is to be made on the 30th inst. by a private company for powers under the Light Railways Act, 1896, to construct electric tramways in East Cheshire and West Derbyshire, between Stalybridge and Hyde, on the one hand, and Glossop on the other. Already the Manchester Corporation cars run out in the Ashton and Stalybridge direction. It is proposed by the East Cheshire Light Railways Syndicate to construct and work a system of tramways from Masham, as a centre connecting up in the west with the Hyde, Dunkinfield, Stalybridge and Mossley system, and on the east, *viâ* Woodley, with the Glossop and Hadfield Tramways, with two further branches—one to Broadbottomiand the other to Tintwistle, *viâ* Hollingworth. When this is completed there will be a complete tramway service between Glossop and Manchester, taking in, not only the towns mentioned, but also Stockport and Denton. Some weeks ago the Hyde Joint Tramways Board decided not to extend its scheme in the Glossop direction further than the boundaries of the two boroughs, and up to a few days ago it was feared that, after all, the "missing link" would fail to be supplied. That there is a prospect of its being yet carried through has afforded lively satisfaction to the inhabitants of the district. The lines which it is proposed to construct will be on the trolley system, as it is desired to maintain uniformity, and their total length will be 7¼ miles. It is proposed to provide a frequent service of cars at low fares. The route will be a popular one and will not only serve a very large resident population, but will also attract much holiday traffic during the summer months.

East Ham.—At the last meeting of the U.D.C. a letter from the Board of Trade was read sanctioning a loan of £2,700 for the purchase of five new cars. It was reported that the daily car-mileage average was now 2,326, as against 1,859 last year, and that the daily average receipts were £95 5s. 8d., against £65 11s. 0½d. last year. The clerk was directed to approach the Wanstead U.D.C. to get consent to an extension of the tramway along Aldersbrook Road to Park Road. With respect to a suggestion to run motor omnibuses, it was decided that members should visit Hastings to inspect some double-deck 'buses which had been supplied by Messrs. Milnes-Daimler, and were running there.

Kirktintilloch, N.B.—The T.C. has agreed to approach the Glasgow Corporation Tramways to extend its system to the burgh.

Soothill Upper.—The U.D.C. has withdrawn its application for a prov. order to enable it to construct electric tramways between Chidswell and Dewsbury.

(*Continued on page* 869.)


OLDHAM CORPORATION ELECTRIC LIGHTING & POWER.
GREENHILL STATION.
GENERAL ARRANGEMENT OF PIPE WORK - STEAM - EXHAUST - FEED - ETC
Elevation on E F G H J.
Cross section on S T
Cross section on K L
CHIMNEY
Engine Room
Boiler House
Mess Room
Railway Siding
Coal Station
Condensers
Economisers
Churchill Street

THE GREENHILL ELECTRICITY WORKS, OLDHAM CORPORATION.

The year 1892, saw the first electrical undertaking of the Oldham Corporation take definite shape, for in that year the Rhodes Bank station, designed for an output of 720 H.P., was opened. The steady increase in the demand for electricity led to enlargements of that station in October, 1896, and again in September, 1899, until the capacity of the Rhodes Bank site, was practically exhausted.

It was then necessary to consider the future development of the undertaking, and with the decision to carry out an extensive electrical tramway scheme, and the necessity of meeting a rapidly growing demand for energy for power and other purposes, it was decided to acquire a site of sufficient area to meet the requirements of the borough for some time to come, and to erect thereon a new power station.

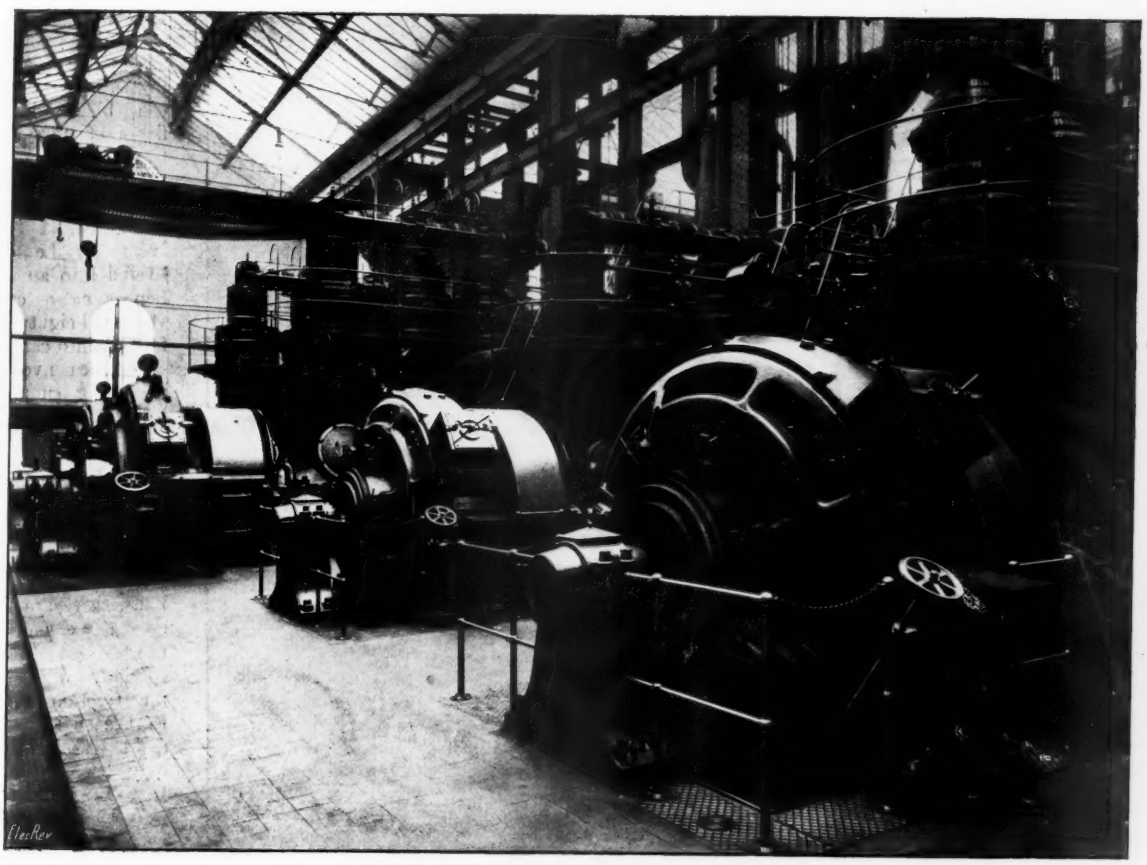
The site was eventually secured at Greenhill, adjoining the railway, and nearly opposite the original Rhodes Bank station. The designing of the new works was entrusted to the Council's consulting engineers in electrical matters, Messrs. Kennedy & Jenkin, of 17, Victoria Street, Westminster, and the works will ultimately cover practically the whole of the available site.

The completed works will comprise an engine room in three bays, running at right angles to the railway, and two boiler houses, one on each side of the engine room, each containing three bays running parallel with the railway, and provided with two square chimneys 250 ft. high, or four chimneys in all.

It will be gathered that the scheme is a somewhat ambitious one, and the section at present completed will accommodate some 10,800 H.P. of the total 21,000 H.P. which it is proposed shall be accommodated on the site.

These buildings comprise an engine room in two bays, 130 ft. long and 88 ft. wide, faced internally with blue Staffordshire bricks to about 8 ft. above floor level, and with glazed bricks elsewhere. The floor is tiled and the roof glazed all over. A spacious switchboard gallery runs across one end of the engine room, and at this end are also situated the engineers' and general offices, built partly over the switchboard gallery, and having the principal entrance in Churchill Street.

One boiler house, situated at the western end of the site, has been constructed. It is 152 ft. 6 in. long and 109 ft. 5 in. wide. Over the boiler house a coal store, capable of holding 1,300 tons of coal, has been erected by the Columbian Co., of London, and is of their patent concrete and steel-bar construction, as also are several fire-proof floors elsewhere in the building. The buildings are, for the most part, of fire-proof construction, and faced externally with red brick and stone dressings.



View of Traction Bay, Greenhill Electricity Works, Oldham.

The arrangement of the boiler plant is somewhat of a departure from the usual practice.

Eight dry-back boilers and three Morrin's patent Climax water-tube boilers are installed, and the latter, on account of their particularly rapid steaming qualities, should prove a valuable addition when the full lighting and traction load is obtained. Ultimately, the two outer bays will each contain eight dry-back boilers, and the centre bay four Climax boilers.

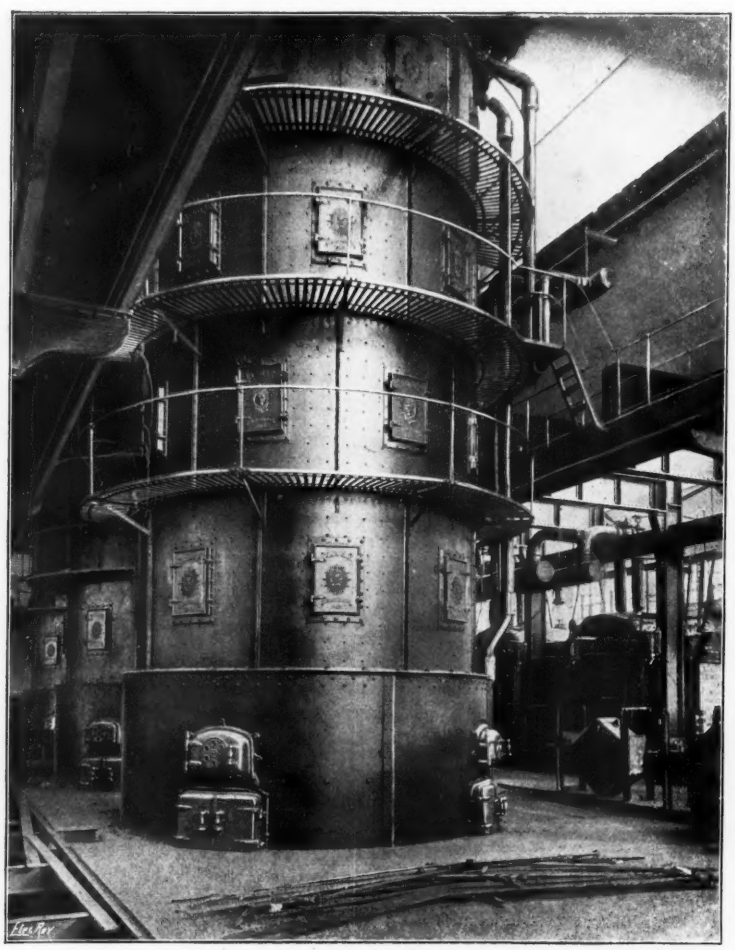
The dry-back boilers have been supplied by Messrs. E.

F

Danks & Co., of Oldbury. They are 11 ft. 6 in. diameter, and 14 ft. long. Each boiler has two Fox's corrugated flues, and contains 214 tubes 3 in. in diameter. The furnaces are fitted with Butterworth's fire bars, and two spring loaded safety valves are provided to each boiler. These boilers have been designed to evaporate 11,500 lbs. of water per hour, with a working pressure of 160 lbs. per sq. in., and are arranged so that mechanical stokers can be added if desired.

The main flue on the north side of the boiler house is under the firing floor, and on the south side, behind the boilers, both lead into the chimney, which is situated in the centre bay of the boiler house, adjacent to the engine room. The chimney, which is similar in size to the other three which will ultimately be erected, is 250 ft. high and 12 ft. square internal measurement.

The Climax boilers, which, together with the pump room and feed heaters, occupy the remainder of the centre bay, were supplied by Messrs. Rowland & Co., Ltd., of Reddish. Each boiler is designed to evaporate nominally 25,000 lbs. of water per hour at a working pressure of 160 lbs. per sq. in. The boilers contain a central shell 4 ft. 4 in. internal diameter, into which are expanded 720 bent tubes, each 3 in. diameter and about 11 ft. 9 in. long. The feed water enters the central shell through a flat feed heater coil about 350 ft. long, placed at the top of the boiler casing. The flue for the Climax boilers runs under the roof of the centre bay, some 50 ft. above floor level, entering the chimney through an opening in the side. These boilers are also arranged for the addition of mechanical stokers if desired.



View in Boiler House, showing Climax Boilers, Greenhill Electricity Works, Oldham.

The feed system to the boilers is in duplicate. Two feed pumps, single and compound, of the Weir direct-acting type, with capacities of 8,000 and 16,000 gallons per hour, are installed in the pump room. The feed water is drawn from the feed tank situated over the pump room, having a capacity of about 14,000 gallons, or from the hot-well tank, and is pumped through one or other of two Berryman patent feed heaters to the duplicate feed pipe lines. A Glenfield and Kennedy water meter is provided in the pump delivery to each feed line, and bye-passes are provided to the feed heaters to enable direct feeding to be used if desired.

The Berryman feed heaters are each capable of raising the temperature of 50,000 lbs. of water per hour, at least 150° F.; they were supplied by Messrs. Babcock and Wilcox. The feed heaters have been erected in a recess between the chimney and the west wall of the engine room.

The main atmospheric exhaust pipe, which is 3 ft. 6 in. in diameter, passes through this recess and is carried up inside and to the top of the chimney. The exhaust may be taken direct up the chimney or bye-passed through either or both feed heaters. As the Climax boilers have their own heating coils, a direct connection from the pumps to the, has been provided.

Two ranges of coal bunkers have been erected in the side bays of the boiler house. The coal from these will be fed to the stoking floor through 16 5-cwt. measuring boxes supplied by Messrs. Graham, Morton & Co., Ltd., Leeds, and through shoots which will eventually be taken direct to the hoppers of the mechanical stokers.

A conveyor of the Hunt type will be provided to each coal bunker; each will have a capacity of 8 tons per hour. The conveyors will carry the coal from a range of hoppers which have been built on the level of the railway on the north side of, and parallel to, the boiler house. A railway siding will be carried over the hoppers, and a weigh-bridge provided for enabling a check to be kept on the total amount of coal supplied to the station.

In addition to the coal conveyers, Hunt continuous ash conveyers, each having a capacity of 1 ton per hour, are being provided in subways under the boiler house floors of the side bays. Hatches are provided for the reception of the ashes, which will eventually be delivered into an ash hopper at a convenient height for feeding into carts.

All the conveyers are being supplied by Messrs. Babcock and Wilcox, Ltd., and will be driven by suitably geared electric motors.

In the two bays of the engine room which have been built, there are installed six generating sets; four specially intended for traction work in the west bay, and two for lighting only in the east bay. The engines are all of the Willans compound three-crank type, and are direct coupled to multipolar generators of Messrs. Siemens's make.

The two smaller engines in the traction bay are Messrs. Willans's 3/8 size, capable of giving about 600 H.P. when running at 300 revolutions per minute, and they are coupled to 370 KW. compound-wound generators giving 840 amperes at 500—550 volts as shunt machines, and 675 amperes at 550 volts when compounded. These sets are for traction purposes only. The two larger engines in this bay are of Messrs. Willans's 3 V size, rated at 1,200 H.P. when running at 230 revolutions per minute.

These generators are compound wound for traction work with an output of 740 KW., but are also arranged to run as shunt-wound machines for lighting purposes. Their output is 1,345 amperes at 450—550 volts. The two generating sets in the east bay are similar to the two large traction sets above, except that they are shunt wound, and will be used for lighting only,

No balancing plant has been put down at this station, for the low-tension lighting network, this being done at the old station at Rhodes Bank.

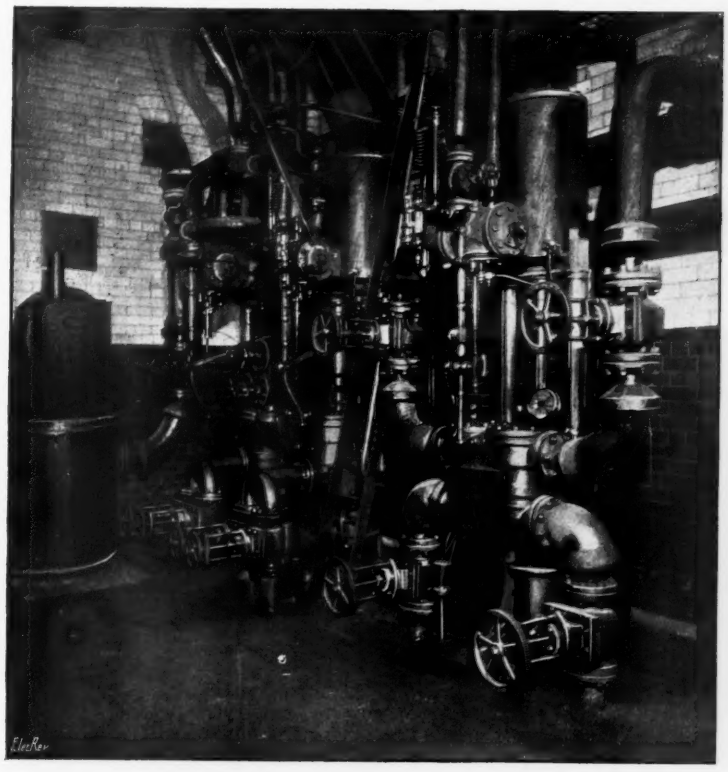
A 15-ton travelling crane is provided in each bay of the engine room; they were supplied by Messrs. T. Broadbent and Sons, Huddersfield, and are each 38 ft. span. Each crane is provided with three motors and suitable controllers for operating the lifting and travelling movements, both motors and controllers being supplied by the Lancashire Dynamo Co. The cranes can be worked from either the lighting or traction circuit.

(To be continued.)

ELECTRICAL EXHIBITS AT ST. LOUIS.

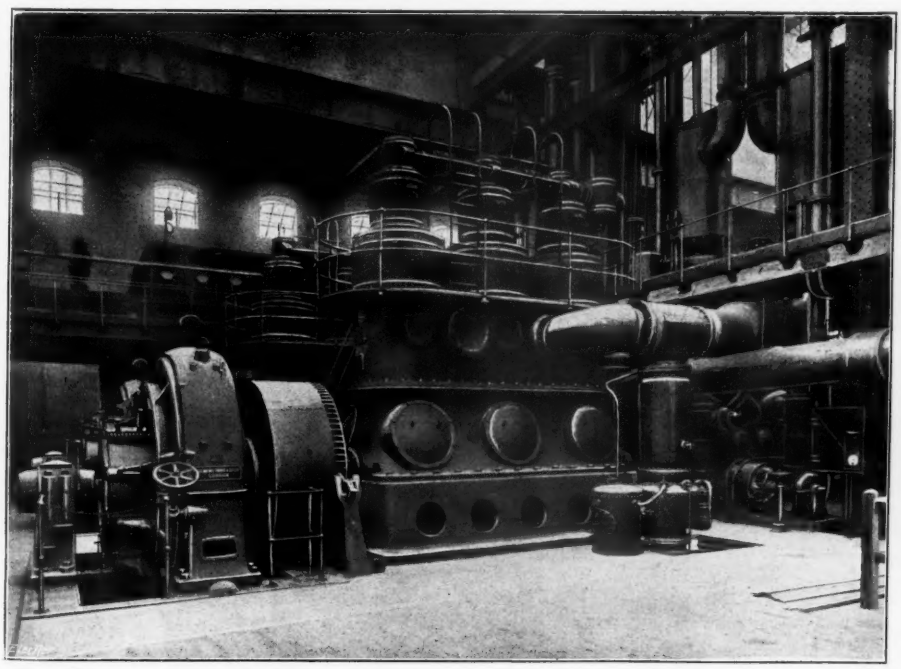
The Electricity Building promises to be one of the greatest centres of attraction next year, on account of the large number and variety of operating exhibits. Many of the prospective exhibitors have already visited the Exposition, and have expressed themselves in very enthusiastic terms about the favourable location of the building, its excellent arrangement for displaying exhibits, and the facilities for showing all kinds of machinery at work. A view of the north-west corner of the Palace of Electricity is shown on the next page.

The application of electricity to every branch of industry has made such a great advance in the last ten years, that many of the exhibits shown here will be entirely new to the public in general. A few of the special features are enumerated below.



Weir Feed Pumps, Greenhill Electricity Works, Oldham.

The largest classification both in area of space and number of exhibits will be that of machines for generating and using electricity. Dynamos and motors of all the principal makes, both alternating and direct current, will be on exhibition, most of them running. The largest of these machines will be erected under the travelling crane along the west side of the Electricity Building, so as to facilitate the placing and removing of heavy parts. Motor-generators, rotary converters, transformers, rheostats and regulators of every form will be so arranged and connected as to demonstrate their various functions. There will be shown, many ingenious applications of motors to the diverse forms of machinery, in which so much progress has been made in recent years. The principal companies in the electrical industry are mainly interested in this general classification, and their exhibits in the group will do credit to themselves and to the Exposition.



1,200 h.p. Lighting Sets, and Condensing Plant, Oldham.

Opportunity will be given for both still and live exhibits in the street railway field. Those exhibits within the Electricity Building will be chiefly motors, controllers, switchboards and auxiliary apparatus. Outside there will be a double testing track, about 1,400 ft. long, upon which speed, acceleration, braking and efficiency tests can be run. Electric railway equipments of standard form will be tested, and not only this, but systems now being developed will be given an official trial. Signal apparatus and safety devices of every form will have opportunity to demonstrate their utility.

Expositions both in this country and Europe have marked each great step in the advance of high pressure electrical practice, and St. Louis is to be no exception. Arrangements

have been made and are in progress for showing the phenomena of high pressure currents beyond anything in this line attempted in previous Expositions. While proper safeguards will be used at such demonstrations, yet it is intended to make them in such a way that the general public as well as electrical engineers may profit by them.

Perhaps the wireless telegraph and telephone exhibits will attract as much attention as any other feature on the grounds. The largest wireless telegraph station ever erected will have a conspicuous location, where visitors may send messages to St. Louis and adjoining cities, in the same manner and with the same expedition as they would send over a telegraph line.

Several investors and companies have prepared plans for exhibits of wireless telephony over comparatively short distances. The telephone stations, separated by the length of the building, will be used without any metallic connection between the two. The waves will emanate from the coils of one station, and will induce corresponding pulsations in the coils of the receiving station, so that a conversation can be heard from one to the other.

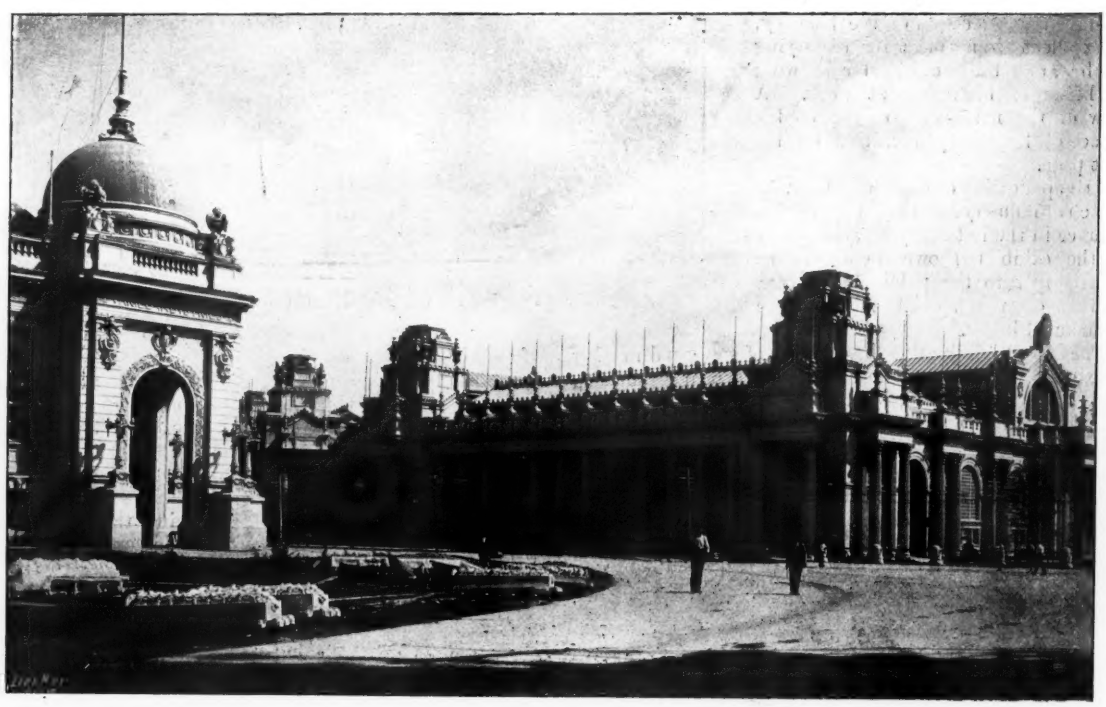
It is probably that no branch of therapeutics has made a greater advance than the electrical. Electricity in the form of direct, alternating and intermittent current, is now utilised in the treatment of many forms of diseases, especially chronic cases, which have been especially refractory. This type of apparatus will include X ray tubes for physical treatment and for diagnosis, and the Finsen lights giving actinic or higher light rays, which are supposed to be especially efficacious in the treatment of certain kinds of diseases.

Electro-magnetic instruments will also be on exhibit, and will be shown in operation for the special treatment of ear diseases. The acousticon, an instrument which very largely performs the function of the ear, will be graphically demonstrated. On account of the great number and variety of exhibits in this classification, the Electricity Building will prove a centre of interest to the doctors and physicians who are keeping abreast of the times in their particular work.

A large number of inventions in electric lighting have been made in recent years, and these will all be demonstrated in a way which will be exceedingly attractive to the public. Arc lamps of every kind, and incandescent lights of every size and colour will be displayed. Nernst lamps will be utilised in lighting one of the buildings. The Cooper-Hewitt vapour arc lamps will illuminate the cascades, and will be shown inside the Electricity Building. Vacuum tube lighting by means of induced currents will also be shown.

In the field of electro-chemistry, many new processes have lately been developed into commercial possibilities. A number of the great manufacturing companies at Niagara Falls and other water-power centres, have decided to show their electric furnaces and chemical processes in operation. The products of these furnaces are, as a rule, much purer than the products which are made in any other way, and it will be of interest to the public to see the operations and the chemical changes, which occur under the influence of the electric arc.

Arrangements have been completed for the establishment of special laboratories in the Electricity Building, with complete sets of recording instruments, whereby the juries of award and exhibitors may conduct careful and accurate tests upon every kind of electrical apparatus which may be shown in the Electricity Building. The presence of such laboratories at an exposition is a new departure, and will add greatly to the value of the awards, as the personal factor and the personal judgment of the jury will be minimised, because the actual data regarding the performances of the machines or mechanism can be accurately ascertained.



The Palace of Electricity, St. Louis International Exposition.

A number of historical exhibits of very great merit are to be placed in this building. Mr. T. A. Edison, chief consulting electrical engineer of the department, has planned a personal exhibit, showing the earliest forms of the incandescent lamp, phonograph, generators, and other mechanisms towards which he has contributed so much. The storage battery which he has designed especially for automobile use, combining light weight with high discharge rates, will claim the attention of engineers as well as of the public.

The International Congress of Electricity, which is to be held from September 12th to 17th of next year, will draw a large number of eminent foreign engineers to St. Louis, as is indicated by letters from various European organisations to the Exposition officials. The Committee on Organisation has held several important meetings attending the preliminary business of the Congress. The sessions will be held in the beautiful hall of the Library building.

Through the American Institute of Electrical Engineers, all kinds of early types of electrical machines and apparatus will be shown, and this temporary collection promises to be the most complete ever gathered together. Displays from several associations, universities and laboratories will contain

delicate and accurate instruments, as well as showing methods of research work. It is intended to make these exhibits, which are not commercial in character, highly educating to the public, and thus to dispel to some extent the mystery which enshrouds the layman's mind in all things pertaining to this form of energy.

Electricity is undoubtedly the greatest agency in making an exposition brilliant and successful. In addition to its manifestations of light and power, the electrical exhibit will be the epitome of all that electricity has contributed to art, science and industry up to the present day.

ELECTRIC TRACTION NOTES.

(*Continued from page* 863.)

Belgium.—The Communal Council of Ghent has decided upon the substitution of overhead traction in place of battery traction. A new station will be constructed by the Société l'Union, which company has secured the concession in defeating the old tramway company and the Allgemeine Elektricitäts Gesellschaft. During two years the service of electricity would be assured by the Société l'Union, which will furnish the current to the tramways at cost price. The town will subsequently take over the power station, and continue to supply the current to the tramways at the price established by l'Union.

Glasgow.—Application have been made by the Glasgow and South-Western Railway Co. for certain powers, *inter alia*, to work their line by electrical power, or partly by electrical and partly by other mechanical power.

The T.C. is considering a proposal to give a bonus to motormen on account of freedom from accidents, &c.

The extension of the Corporation tramways from Crookston to Hawkhead, in connection with the extension to Paisley, was opened on Wednesday.

Gloucester.—The chairman of the Tramways Committee has reported that the 20 cars on order with the Brush Co. will be insufficient to meet the expected traffic at busy times. It is suggested that eight extra cars should be ordered from the Brush Co. on the same terms as those at present being made (£400 each). The 20 are to be delivered in January. Mr. Law is making satisfactory progress with the track construction.

Italy.—The Northern (Italian) Railway Co., of Milan, has just lodged an application with the Italian Minister of Public Works for a catchment of water on the River Liro equivalent to 1,600 litres per minute, which with a head of water of 246·20 metres would develop a force of 5,600 H.P. The power thus obtained would be applied to the production of electric energy for the working of the company's system between Milan and the Lakes of Alpine Italy as well as several lines of tramway. The energy would also be utilised for other industrial purposes. The project comprises the construction of a power station on the left bank of the Liro, near Chiavenna. The hydraulic installation will consist of five horizontal turbines, each of 1,000 H.P. A three-phase alternator of 730 KW. will be coupled to each turbine, and the pressure will be transformed from 2,000 to 30,000 volts for transmission. The estimated price of the projected works is fixed at 2,096,800 lire.

Leicester.—It was announced at the meeting of the Leicestershire County Council that the negotiations with the Corporation respecting the construction and leasing of the two lengths of light railway (the one to Oadby, 7 furlongs 5 chains, and the one to Thurmaston, 1 mile) had fallen through, as the Corporation was not now prepared to carry out the suggested arrangement which was set forth in the report presented to the Council at the May meeting.

Liverpool.—A new tramcar cover is being tried on the Liverpool tramways. The construction is light, and there is a permanent curved top of light wood. The sides and ends of the cover are glazed, the inside of the cover accordingly being weather tight.

London.—The Camberwell B.C. and the other local authorities through whose districts the lines of the London Southern tramways pass, have received letters asking if the L.C.C. agrees to acquire the undertaking whether the Borough Councils will consent to the adoption of overhead traction and to the doubling of the lines where necessary. The communications further state that the Highways Committee can only recommend the County Council to purchase the undertaking on the basis indicated.

The St. Pancras B.C. has rescinded a decision come to by the previous Council, and adopted by 36 votes against 20 a resolution giving statutory consent to the construction of a tramway connecting with the tramway in Hampstead Road and passing across Euston Road and along Tottenham Court Road to a point opposite the Horse Shoe Hotel.

Elberfeld Railway.—According to the daily Press, several fires have recently occurred in this suspended railway, with the result, it is said, that the public are boycotting the line.

Paisley.—An agreement has now been drawn up between Mr. Murphy, who is constructing the Paisley District Tramway lines, and the Corporation, in regard to the question of stone setts, and the dispute is now settled for good.

Rainham.—The U.D.C. here and those of several surrounding localities have received notice from the Kent Electric Light Co. that it does not propose to proceed further this session with its electric tramway extension scheme.

Romford.—Powers are being sought by the Empire Electric Light and Power Co. to construct electric tramways at Hornchurch, Heath Park, Mawney Road and Victoria Road. No opposition is anticipated.

Russia.—The Helios Elektricitäts Aktien Gesellschaft, of Colonne, has obtained an order for the electrification of the Tiflis tramways, in Russia. The total amount of supplies and works will reach the figure of 5,000,000 marks, which includes the installation of the power station and the supply of 70 motor-cars.

Shildon.—The United Kingdom Electrical Syndicate has informed the U.D.C. of its intention to apply for powers to construct electric tramways from Coppy Crooks to Church Street.

South Lancashire.—A parcel service has been established on the South Lancashire Tramways, by which parcels not exceeding 112 lbs. may be sent over the company's system, to or from Liverpool or Birkenhead. The parcels will be collected, carried by tramcar, and delivered at the following rates:—Up to 3 lbs., 3d. each; up to 14 lbs., 4d. each; up to 28 lbs., 5d., and so on in proportion. Collection and delivery will be made within reasonable distances of the tramway stations. The company have decided to proceed with the construction of the projected lengths of tramways which will connect the existing lines with Manchester, so establishing tramway connection between Manchester, Liverpool, and other towns.

Stockport and Macclesfield.—A syndicate has been formed to obtain powers for providing electric tramways for the district, partly urban and partly rural, between the towns of Stockport and Macclesfield. Between Manchester and Stockport communication is already established, and horse cars are run from the latter town to Hazel Grove, about four miles, by a private company. It is proposed by the syndicate to take over and electrify this company's undertaking, and to extend the tramway through Norbury, Poynton and Butley to Macclesfield, and as far as Broken Cross. This will involve the construction of an additional 14 miles of track. Power is also to be sought for supplying electricity in bulk to the local authorities *en route* and to the town of Macclesfield.

TELEGRAPH AND TELEPHONE NOTES.

Cables Laid on Ground.—We read in the *Electrical World* that with the idea of overcoming the suspension of communication with the north from Vancouver, B.C., by the Government telegraph being broken by heavy snow falls, the Dominion Government will lay a cable over three ranges of mountains, strong enough to withstand whatever may fall upon it. E. A. Hawley, one of the foreman in charge of the construction in the north, who is now in Vancouver, said that sleet is the worst enemy of the telegraph lines in the north. The lines are being constantly broken and it is often very difficult to find the ends in the snow. Last winter the experiment was tried of laying a cable over the mountains, allowing it to be covered by the snow, and although it was not a complete success, it demonstrated the fact that with a proper wire there would be little trouble. A heavier and properly insulated cable is now being prepared of sufficient length to extend over three ranges of mountains, where the present trouble is experienced.

French Submarine Cables.—The French Senate, at its meeting of the 17th inst., passed the first reading of a Bill authorising the Government, under certain conditions, to expend about £920,000 for the laying of submarine telegraph cables to connect Brest with Dakar; Madagascar with the Island of La Réunion, and the latter with Mauritius; and a fourth cable to be laid from Saigon to Pontianak, in Borneo, touching at Poulo-Condor.

Glasgow Telephones.—Mr. A. R. Bennett resigns the position of general manager and consulting engineer of the Glasgow Corporation Telephone Department at the end of the present financial year, and the Committee recommend to the T.C. the appointment of Mr. John Macfee, assistant manager. Mr. John M'Cullum, cashier, is recommended for the post of assistant manager. The number of telephones subscribed for and connected with the system has reached the total of 10,322.

Telegraph Speeds.—The Eastern Telegraph Co. and the New Pacific Line made a new record on Saturday in their race to secure supremacy for lightning telegraphing of big events from Australia. Both authorities had the same identical message handed to them at Sydney at 6 p.m. to dispatch to London. The time of transmission was 13 minutes, an absolute record for a public message from Australia. The Pacific telegram sent over the new route and re-transmitted over the Anglo line was less than one minute behind it.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted.	Repaired.
Dominica-Martinique	.. May 5, 1902 ..	..
St. Lucia-Martinique	.. May 7, 1902 ..	..
Anjer-Kalianda	.. Aug. 2, 1902 ..	..
Cayenne-Pinheiro	.. Aug. 13, 1902 ..	..
St. Lucia-St. Vincent	.. Sept. 19, 1902 ..	..
Reissa-Issa (Yemen)-Camaran	.. Oct. 22, 1902 ..	..
Paramaribo-Cayenne	.. Feb. 26, 1903 ..	..
New York-Hayti	.. April 13, 1903 ..	..
Trinidad-Demerara No. 1	.. Aug. 27, 1901 ..	..
Tourane-Amoy	.. Nov. 10, 1903 ..	..
Accra-Lagos	.. Nov. 14, 1903 ..	Nov. 22
Lagos-Brass	.. Nov. 14, 1903 ..	..

Wireless Telegraphy.—A telegram from Rome says that the tariff for Marconi wireless telegrams has now been fixed. The charge between Rome and England will be 1d.; between Rome and the United States and Canada, 3d.; and between Rome and Argentina, 4d. a word.

CONTRACTS OPEN AND CLOSED.

OPEN.

Brighton.—December 7th. Six water-tube boilers, piping, tanks, and sundry other steam plant, for the Southwick power station. See "Official Notices" November 6th.

Crewe.—December 4th. Wiring the new municipal offices. See "Official Notices" November 20th.

Dublin.—November 30th. Stores for the Dublin United Tramways Co. See "Official Notices" November 13th.

Great Western Railway.—December 7th. Water-tube boilers, engines, three-phase generators and auxiliary plant, for the Park Royal power station. See "Official Notices" November 6th.

Hornsey.—November 30th. Meters, indicators and fuse-boxes. See "Official Notices" November 6th.

Italy.—November 30th. The Municipality of Canosa di Puglia (Bari) is inviting tenders for the installation and working of an electric lighting station for public and private purposes in the town.

King's Norton and Northfield.—Cables for the tramways. See "Official Notices" to-day.

Lancaster.—The T.C. has authorised the Tramway Committee to arrange for the purchase of 80 tons of rails, for the doubling of the line in South Road.

L.C.C.—December 8th. Electric wiring of five sub-stations and three tramway car-sheds. See "Official Notices" November 13th.

L.C.C.—December 8th. Four 3,000-KW. three-phase generators, with exciters, for the Greenwich tramway power station. See "Official Notices" November 13th.

L.C.C.—January 19th, 1904. Six electrically-driven three-throw boiler feed pumps for Greenwich power station. See "Official Notices" November 20th.

Middlesbrough.—November 28th. One 600-KW. steam turbine dynamo; Lancashire boilers, condensing, and other plant. See "Official Notices" November 13th.

N.E. Railway.—December 7th. Tenders for six months' supply of telegraph apparatus, wire, and stores, are wanted by the secretary of the company at York.

Preston.—December 12th. Traction switchboard and accessories. See "Official Notices" November 13th.

Sydney (N.S.W.).—December 30th. Telegraph, telephone, and electric light material for the Deputy Postmaster-General of Sydney. See this column for November 6th.

Trimdon Grange (Durham).—December 7th. The owners of East Hetton, Trimdon, and Trimdon Grange Collieries, invite tenders for 12 months' supply of electric light fittings, &c. Particulars and conditions from the store-keeper, Trimdon Grange Colliery Co., Durham.

Wimbledon.—December 8th. Water-softening and storage plant. See "Official Notices" November 20th.

CLOSED.

Bath.—The British Westinghouse Co. has secured a further order for ten magnetic brake equipments for the new cars of the Bath Electric Tramways, Ltd. These sets will be duplicates of those already ordered by the same company.

Brighton.—The T.C. has accepted the tender of the General Electric Co. (1900), Ltd., for 31 street police calls fire alarms and a 30-line switchboard at the police station, at £368.

Dartford.—The U.D.C. has accepted the tender of Messrs. W. T. Henley's Co. for laying cables in Dartford Road to the St. Vincent Schools at £463, and also for the supply of house services.

Leeds.—The T.C. has accepted the tender of Messrs. Edgar Allen & Co., Ltd., for the supply of points, crossings, and special track work for tramway junctions.

West Ham.—The Corporation has placed an order at £619, with Messrs. Macartney, McElroy & Co., for the overhead equipment of the interior of the car-shed in West Ham Lane.

Wigan.—The T.C. has accepted the tender of Messrs. Johnson & Phillips for the supply of electric light cables.

FORTHCOMING EVENTS.

Friday, November 27th.—At 5 p.m. Physical Society. Meeting at the Royal College of Science. "An Electrical Thermostat," by Horace Darwin; "On the Occurrence of Cavitation in Lubrication," by S. Skinner; "A Lecture Experiment in Electrical Resonance," by Dr. W. Watson.

Saturday, November 28th.—At 7.30 p.m. Glasgow Technical College Scientific Society. Mr. J. H. Pocock on "Some Remarks on the Willans Engine."

At 10.30 a.m. Institution of Electrical Engineers (Students' Section). Visit to the County of London and Brush Co.'s works at City Road.

Monday, November 30th.—At 7.30 p.m. Society of Engineers. Paper by Mr. A. Gay on "Mechanical Stokers for Electricity Generating Stations."

Institute of Marine Engineers. "Fuel Testing," at 58, Romford Road.

Tuesday, December 1st.—London Electrical Contractors' Association. Mr. F. B. Joseph on "Are we Tradesmen?"

Wednesday, December 2nd.—At 7.30 p.m. Institution of Electrical Engineers (Students' Section). Paper on "The Operation of Electric Lifts," by Mr. H. Church.

Liverpool Engineering Society. Mr. E. J. Hidden on "Recent Telephone Developments in Liverpool."

At 8 p.m. Society of Arts. "The Fiscal Problem," by Sir Chas. M. Kennedy, K.C.M.G.

Thursday, December 3rd.—At 8 p.m. Institution of Electrical Engineers (Birmingham). Opening meeting. Mr. J. C. Vaudrey will deliver his address.

At 8 p.m. Chemical Society. Paper by Mr. G. T. Moody on "The Atmospheric Corrosion of Zinc."

Friday, December 4th.—At 8 p.m. Junior Institution of Engineers. Paper on "Recent Developments in the Construction and Working of Gas Engines," by Prof. D. S. Capper.

At 8 p.m. Institution of Civil Engineers (Students). "Artificial Draught as Applied by Fans to Steam Boilers," by W. H. A. Robertson.

Saturday, December 5th.—At 7.30 p.m. Glasgow Technical College Scientific Society. Mr. W. H. Booth on "Superheat."

NOTES.

Electrical News from Mauritius.—News which has lately come to hand from Mauritius shows that electrical things are going ahead there. The electrical lighting regulations in force are technically the same as those of the British Board of Trade. In regard to overhead wires there are certain rules, but to some of these is added the proviso, "Unless permission to the contrary be granted in writing by the Surveyor-General," so that each application for powers is considered on its merits. The Mauritius Hydro-Electric Co. has a 15-year concession of a small waterfall, from which it can get enough power to work a 60-KW. dynamo. It distributes a single-phase current at 2,000 volts to several villages within a radius of three miles, and lights up a number of Government establishments. In return for the concession they supply 200 lamps to the Governor's residence free!! They supply current to the public at the rate of about 40 cents of a rupee per unit. The company is remarkable, inasmuch as it is purely Indian. American apparatus is used, and, of course, bare overhead wires. One man has been killed by fallen wires during three years' operation. It is probable that the company will shortly change its system to three-phase.

A small installation is to be put down for the Government waterworks filter beds, also one for the Royal Observatory. For the filter beds plant plenty of water at a head of 165 ft. is available, but for the observatory installation a small oil engine will do service.

The installation for the Government Central Railway Station at Port Louis will be driven by an old steam engine the first year, but will be replaced by an oil engine in the second year. The arc lamp-posts are to be made locally from old rails.

The Government railway workshops at Plaines Lauzun afford a very good case for the substitution of electric driving. Coal costs 35s. per ton, and an old locomotive engine, non-condensing, and using steam at 120 lbs., is used for driving the various workshops. The coal consumption is about 6 lbs. per I.H.P.-hour. There are several right-angle transmissions, &c., in the shafting between the various shops. As it has been found possible to buy electric energy from the nearest supply company at about 9 cents per unit for a day load, a report was prepared by the Government expert and accepted, and tenders have lately been invited for the supply of electric energy. The power required is only about 80 H.P., but it is estimated that there will be a *net* yearly saving of about R. 6,000. The matter will be provided for in next year's estimates.

Port Louis has its municipal electrical scheme, but for the moment it is in abeyance, as the constitution of the municipality is now undergoing reorganisation at the hands of the Government. When this is settled probably the scheme will arise again.

There are at present many new branch lines of railways under construction, and the question is now under consideration to what extent it would be economical to use electricity on these lines, as well as on the main lines. With coal at 35s. per ton and cheap water power available, the prospect for electrification is hopeful.

The Curepipe Electric Light and Power Co., which has had a chequered career since it commenced operations in 1887, has now "developed" a waterfall four miles from Curepipe, and uses a 6,600-volt transmission.

It is stated that the quality of the engineering work to be seen in Mauritius is not at all brilliant, and, indeed, there is said to be not an electrical engineer of any sort at work.

An interesting comment passed upon the situation from an electrical trading point of view is the following:—"Mauritius being a British Colony, it is perhaps unnecessary to remark that the majority of the electrical machinery here is American and German."

Electrical Engineers R.E. (V.) Concert. — On Thursday evening last week a "Ladies' Night" concert, the first of the kind, we believe, was given at the head-quarters of the regiment, Regency Street, Westminster. A fairly good gathering of members and friends resulted, and the programme contained a number of items which so evidently pleased the audience that we hope to see these entertainments become a regular feature with the Electrical Engineers Volunteers during the winter. There is much latent talent amongst the members, and outside assistance can readily be obtained. Mrs. Barker is an adept at recitations, and quickly secured the sympathies of her listeners; while Miss Gwennie Mason, a youthful performer of 18 summers, charmed everybody with her performances on the harp, her playing being remarkable for one so young, and auguring well for her future career as an artiste. Corporal D. C. Mackenzie Hume mystified the onlookers with some cleverly-manipulated card tricks; Miss Amy Fowler sang "Coon Songs," to her own guitar accompaniment, while Miss Grace Barker and several members of the corps sang more or less well-known ballads, much to the satisfaction of those present. Major Erskine gallantly occupied the post of chairman, and he was surrounded by quite a number of his brother officers. What with the brilliant uniforms, the charming dresses of the ladies, the more subdued clean biled rags and clawhammers of some of the male performers and visitors, and the decorations, the drill hall presented an unusually attractive and animated appearance, and we congratulate Major Erskine, who, we believe, was responsible for the concert arrangements (although we suspect Mrs. Erskine made a good aider and abettor) upon a decidedly successful evening.

The I.E.E. and the King of Italy.—On Friday evening last a deputation from the Institution of Electrical Engineers was received by H.M. the King of Italy. The deputation, which consisted of Mr. R. K. Gray, the President, Lieut.-Col. Crompton, Sir H. C. Mance, Dr. J. W. Swan, Prof. S. P. Thompson, and Mr. McMillan, the secretary, was received in the Vandyck Room of the Castle, being introduced to his Majesty by Lord Kenyon, Lord-in-Waiting. The King shook hands with the members of the deputation, graciously received the address, and entered into a general conversation, in the course of which he showed an intimate knowledge of the progress of electrical and telegraphic science and engineering in his dominions. The deputation retired after spending about 10 minutes in this way with the King, and after taking tea returned to London. Telegrams expressive of cordial feelings passed later in the day between the Associazione Elettrotecnica Italiana, the Milan Section of the Associazione and the London Institution.

The address which was presented to his Majesty referred in happily chosen and very appropriate terms to the friendship and hospitality which were so liberally shown on the occasion of the Institution's visit to Northern Italy last spring.

An American View of the Protection Proposals.—The *Western Electrician* which has come to hand this week contains the following editorial notice:—"If one stops to consider that nearly half of the exports of electrical machinery from the United States in the year ended June 30th, 1903, went to the United Kingdom, it will be seen that the protective-tariff proposals of Mr. Joseph Chamberlain are of direct interest to the electrical manufacturers of this country. The total exports of electrical machinery (in which electrical appliances, including telegraph and telephone instruments, are not included) for the year mentioned were valued at $5,779,459, and of this amount the United Kingdom took $2,256,062 worth. Mr. Chamberlain proposes a duty of 10 per cent. *ad valorem* on all manufactured goods imported into Great Britain, and if his ideas prevail, as is quite possible, American electrical manufacturers will have to meet this new handicap. It behoves the exporters of this country to watch the British situation carefully that they may meet the changed conditions should they arise."

Royal Commission on London Locomotion.—This Commission sat again at the Westminster Palace Hotel on Friday, under the chairmanship of Sir D. Barbour, when evidence was given by Superintendent Cole, of the E Division of Police. He called attention to the obstruction caused by tramway termini. In his division they had tramway termini at Gray's Inn Road and Theobald's Road. Apart from the termini the tramways did not cause a great deal of obstruction in the street. He thought that the tramways should provide sidings off the streets for their termini, while in narrow streets termini should be prohibited altogether. A great deal of obstruction was caused by the openings in the streets made by electric light, telephone and other companies. The companies took a great deal of time over the work and did not work during the night, as they might. The police had no control over such works.

Superintendent Powell, of the T Division, which stretches from Fulham to Acton, and includes Hammersmith, Shepherd's Bush, Brentford, &c., said the electric cars of the London United Tramways Co. ran through his district. In King Street, Hammersmith, great inconvenience was caused by the electric tramways owing to the narrowness of the street, but he was of opinion that the great convenience of the tramways to the travelling public outweighed other disadvantages. There was also great congestion owing to the narrowness of High Street, Brentford, and it was no uncommon thing to see eight or ten tramcars waiting owing to a tradesman's cart being on the line. He thought there should be no stopping places for tramcars in narrow streets. The Shepherd's Bush terminus was in the middle of the street opposite the Tube Railway, and there was often a great rush of passengers, which he considered not only an inconvenience, but a danger. He thought the loop system would be preferable to the terminus. At Kew Bridge there was a kind of siding, and there was not so much danger or inconvenience. If it were possible to have a kind of station for the tramcars to draw into at termini, it would be better. In cross-examination, the witness said he was certainly of opinion that no tramway ought to be allowed in High Street, Brentford. The High Street was like the neck of a bottle. Judging from the number of passengers using the tramways, he felt that the construction of the large tramway scheme was an advantage.

Superintendent Norris, of the L Division, called attention to the obstruction caused to the traffic by the tramway termini at Westminster and Blackfriars Bridges. He suggested that such termini should not be in a busy street, but in a by-road, or on private ground.

Electrical Mail Vans.—A number of electrical motor vehicles are being built for the use of the Postal authorities at Munich, Germany, for the transport of mails between the various post offices. They are of a small type, intended to carry a load of only 2 cwt. at an average speed of 9½ miles per hour. They will be equipped with a small battery of Tudor accumulators, while two spare sets will be kept at the charging station, one of which will be always ready charged in time for it to be quickly substituted for the discharged battery.

A number of electric motor vans has just been put into service by the Postal authorities at Philadelphia, U.S.A., for the conveyance of the mails between the G.P.O. and the railway stations.

French Competition for Electric Motor-Vehicles.—A French daily, *Le Monde Sportif*, is this week holding a competition of electric motor-vehicles. The programme provides for four daily runs ranging from 90 to 132 kilometres. The points to be taken into account in making the awards are (1) the cost per car-kilometre, (2) the frequency of battery re-charging operations, and (3) comfort.

Appointment Vacant.—Sub-station and outside assistant for Walsall. See our advertisements to-day.

India-Rubber and Gutta-Percha Planting.—The following is an extract from an exhaustive report made by Mr. R. Dupont, the Curator of the Botanic Station in the Seychelles Islands:—

"A good contribution of Para rubber seeds was sent by me whilst in Ceylon in September last. A tin of 2,000 freshly gathered seeds, dipped in a solution of copper sulphate for the destruction of fungi, and sprinkled with crystals of naphthaline, arrived in such good condition that not less than 1,700 plants were distributed and sold at 10 cents apiece two months later. These seedlings are growing well everywhere in Seychelles, and it seems that there is no plant that is better adapted to the climate, soil, and labour supply of this Colony. The seeds are easily available in Ceylon, where planting an acre does not cost more than Rs. 7. All valleys, ravines, river banks, and especially the numerous marshy lands, which amount to several thousands of acres in all the Seychelles Islands, should be planted without delay. The price of Para rubber is rising every day, reaching 4s. 4d. in Ceylon, whilst the cost of tapping is as low as 45 cents in that Colony, where an acre produces 200 lbs. at least.

"*Castilloa Rubber.*—Seeds were sent twice by me from Ceylon, but both consignments miscarried and reached Seychelles only four months after the date of shipping. Only a few seeds brought by me on my return from the East have succeeded, and are now being distributed. A few plants bedded out at the Botanic Station, on Capucin Crown land, and on some private estates, are doing very well.

"West African rubber (*Funtumia elastica*) and Assam rubber (*Ficus elastica*) have also been introduced, the former from the Gold Coast and the latter from Java.

"*Gutta Percha.*—Seeds and plants of the following varieties of gutta-percha have been successfully introduced:—(1) *Palaquium Gutta*, best variety; (2) *Dichopsis obovata*; (3) *Palaquium treubii*;

(4) *Payenia Leerii*. The plants have stood the long transit from Java very well, and some of them have been distributed already."

We may add that Mr. Dupont has made a full report on Para rubber, which will be found among the printed miscellaneous Colonial reports, recently issued. The following is an extract from the annual report of Ceylon for last year:—

"Para rubber is rapidly taking its place as one of the most important of the cultivations of the island, and has been planted up in various climates at different elevations, but will be found, no doubt, most profitable at the lower elevations. During the year some 250,000 seeds have been distributed from the trees in the Henaratgoda Garden. Good yields have been obtained, and the best methods of getting rid of the water and preparing the 'biscuits' for the market are beginning to be understood and practised. Prices have been kept up to a high figure, over 4s. having been obtained for a large quantity. Proposals for experimental plantations of Para rubber under irrigation works in the dry zone are being considered."

Submarine Signalling.—The submarine fog signal of the late Elisha Gray and Mr. A. J. Mundy has been tried by the Metropolitan Steamship Co., and the officers found they could locate the Boston lightship at a distance of three miles or more when approaching at the full speed of 16 knots. The method consists in ringing a submerged bell at the lighthouse by electricity. The sound travels through the water and impinges on two receivers, one on each side of the ship, in connection with a telephone box in the wheelhouse. The observer listens in the telephone and moves a switch to right or left until he ascertains on which side the sound is loudest, that is to say, on which side of the vessel the distant bell lies. By a little manœuvring the captain can get his direction with accuracy.

Electric Resistance of the Human Body.—It has hitherto been supposed that the resistance of the body depends above all on that of the skin, and that the resistance of the skin depends on its vascularisation and its moistness or degree of impregnation with liquids. Experiments by M. Leduc, reported in the *Comptes Rendus*, show that while the resistance comes mainly from the skin, it depends not on moistness or vascularisation, but, as in other electrolytes, on the nature and number of the ions it contains. With the same conditions of size of electrodes, place of application, nature of ions and voltage, the results he obtained were always the same. Measurements of the resistance of the human body made under the same conditions are therefore comparable, and may be utilised for diagnosis.

South African Notes.—Our Johannesburg correspondent writes:—

Middelburg (Transvaal).—The Electrical Adviser to the Imperial Forces in the Transvaal is calling for tenders for the electric lighting of the military cantonments (Royal Engineers) at Middelburg.

Natal Harbour Department.—The tender of Greenwood & Batley, Ltd, for three sets of 4 KW. de Laval turbine-dynamos for lighting the suction-dredgers *Curlew*, *Ibis* and *Water Rat* has been accepted by this department.

Durban.—The borough electrician has been authorised to purchase 120 additional arc lamps, to carry out the improved lighting of the town. In view of obtaining experience on lamps of other types, so as to be able to purchase to best advantage when further supplies are required, 20 each are to be ordered from the following firms, viz., South African General Electric Co., Western Electric Co., Johnson & Phillips, and the British Westinghouse Co; the approximate cost is £5 each.

Potchefstroom.—It is stated that certain of the connections made by the Electric Supply Co. have had to be taken off by order of the Government. This has caused great annoyance to the people concerned, and it is possible that litigation may result. The Government evidently considers that the company has exceeded its powers, but it is thought that the Government should display a greater anxiety to push through a scheme of its own selection, and allow the present company to supply the light until the new contractors are ready with their installation.

Universal Engineers.—We have received from a correspondent a card addressed to him by a firm of "Consulting Engineers and Electrical Experts," with a letter from the firm offering its services. The card sets forth that the firm is "in a position to undertake any branch of engineering, and qualified to bring any work we Dictate or Supervise to a Profitable, Scientific and Satisfactory conclusion both for our Clients and ourselves." The firm's attainments cover the fields of electricity, hydraulics and manufacture, designing machines and factories, architecture, surveying, drawing and designing art metal.

This remarkable firm evidently needs no advertisement at our hands, and we therefore refrain from stating its name. We would, however, advise all other consulting engineers of whatsoever branch of engineering, to look about them for suitable billets at once, as it is evident that their energies will shortly become superfluous in their present capacities. They might form a special fire brigade, to extinguish the Thames, in view of the conflagration which appears probable. And the I.E.E. may hide its diminished head, for this bold and capable firm has set its code of etiquette at defiance!

Cancer and Röntgen Rays.—M. Ribaud in a paper before the Academy of Sciences, Paris, on the cure of cancer in the breast in a woman of 54 years of age by Röntgen rays applied since the middle of July, states that he kept to the same conditions of apparatus throughout the treatment, but varied the number and duration of the exposures; that is, the quantity of rays absorbed. He employed an accumulator of 70 volts and 3 amperes, a Contremoulins-Gaiffe interrupter, a Gaiffe induction coil giving a spark of 0·40 metre, and a large tube or bulb marked Voltohm, of Frankfort, which, when regulated by a phosphorescent screen, yielded a very constant supply of rays of a determinate strength during the exposure. The disease having deep roots, he used average rays, marking six on the radio-chromometer. The cathode was always 0·11 metre from the skin. At first the rays were applied every two days, but latterly at longer intervals. Pain disappeared at the fourth application, and at the sixth the tumour had already lost about a third of its size. The ganglions were gone about the fifteenth. By November 4th the tumour was reduced to one-fourth of its original bulk.

Ipswich Electric Tramways Opening.—On Saturday last the formal opening of the Ipswich electric tramways and lighting undertaking took place.

About noon the door of the main entrance to the generating station, in Constantine Road, was at the invitation of Mr. Jervis, the chairman of the Electric Lighting and Tramways Committee, opened by the Mayoress, a silver key being used for the purpose. Subsequently the guests to the number of 140 partook of a cold luncheon at the invitation of Mr. J. W. Jervis, the company including the High Sheriff of Suffolk, Mr. B. M. Jenkin, of Messrs. Kennedy & Jenkin, the consulting engineers, Mr. Stanley Peach, the architect for the buildings, the Mayor, members of the Corporation, &c.

A somewhat protracted toast list followed the luncheon, and subsequently the ceremony of starting a traction set and lighting balancer was performed by the Mayoress, followed by a tour of the Witton tramway route.

The site of the generating station, car-shed and destructor is on what is known as Seven Acre Field; there is ample space for extensions, and it practically adjoins the G.E. Railway and the River Gipping.

The station buildings include engine, boiler and battery rooms, workshop, car-shed and separate suites of offices for the tramways and lighting staffs. In the engine room there are two 120-KW. lighting sets, two 240-KW. lighting or traction sets, and two 150-KW. balancers. The engines were supplied by the local firm, Messrs. Reavell and Co., and the dynamos, also two motor boosters and the switchboard, were supplied by the Electrical Co., Ltd. A small milking booster for use with the battery is also installed. The battery consists of 248 cells, and has a normal capacity of 400 ampere-hours; it was supplied by the Tudor Accumulator Co. Four dry-back marine type boilers (by Danks, of Oldbury) are at present installed in the boiler house, and a Green economiser is being connected up.

The contract for the steam, exhaust, feed and drain piping has been carried out by the Sir Hiram Maxim Electrical and Engineering Co., this firm also supplying the surface condenser and pumps. The 15-ton engine-room crane was supplied by Messrs. Ransomes and Rapier, of Ipswich.

The car-shed, which occupies a corner of the site, has eight tracks with accommodation for 40 cars. The present contract for 26 cars has been carried out by the British Westinghouse Co., the bodies and trucks being supplied by the Brush Electrical Engineering Co. The cars are of the single truck, double-deck type, and have a total seating capacity of 50 passengers. Three brakes are fitted, slipper, track and electrical.

The refuse destructor is of the Meldrum Simplex type; it is connected to the power station chimney shaft by a considerable length of flue. This chimney is 179 ft. in height and 12 ft. square inside. The contractors for the permanent way were Messrs. Dick, Kerr, Ltd., and some 10½ miles of route have been laid down, partly double track. The contract for the overhead equipment has been carried out by the British Electrical Equipment Co., London.

Messrs. Johnson & Phillips have carried out all the cable work for both the tramways and lighting. The tramway undertaking has cost some £110,000, and an additional outlay of £43,000 has been incurred in street widenings, many of the principal thoroughfares having to be widened.

It will be recalled by those who know the locality that some nine years have elapsed since an electricity scheme was first mooted for the town, and we may, therefore, be excused for doubting the Mayor's accuracy, if not his good intentions, in claiming "Ipswich as a progressive town second to none in the eastern counties." After years of hesitation the Corporation has launched into an exceedingly comprehensive scheme, which would reflect credit on a much larger town, and in this case is likely to require skilful management during the first few years in order to make it a success.

The Engineers' Club.—Under the foregoing title a new association has been formed for the promotion of social intercourse between members of the engineering and allied professions. The programme at present arranged includes a smoking concert at the Westminster Palace Hotel on Friday, November 27th, and a children's party, followed by a Cinderella dance at the Caxton Hall, Westminster, on Saturday, December 12th. An attractive list of other social gatherings to follow is being prepared. The club has been founded under the auspices of the Junior Institution of Engineers, but membership is open to the profession generally upon proper introduction. It is hoped, in the future, to be able to engage permanent rooms so that members may enjoy the usual advantages of a club house. Mr. Fred. S. Pilling, 20, Victoria Street, Westminster, S.W., one of the joint hon. secretaries, will be pleased to answer any inquiries.

Lecture.—At a meeting of the Edinburgh Association of Science and Arts held last week, Prof. Francis G. Baily delivered a lecture on "Recent Advances in Electric Railways and Tramways."

Personal.—Amongst the Italian ladies resident in London who had the honour of being presented to H.M. the Queen of Italy at the Italian Embassy on Thursday last week was Mrs. W. B. Esson. Mrs. Esson, who was born in Rome, bore the illustrious name of Giustiniani; her father, who fought with Garibaldi, was a Roman and her mother a Venetian.

The directors of the Midland Railway have appointed Mr. Richard Mountford Deeley, locomotive works manager at Derby, to be chief locomotive superintendent, in succession to Mr. S. W. Johnson, who retires after 30 years' service. Mr. Deeley was recently sent to America to inquire into engineering methods on American railways.

Mr. E. Garside, who has for the last five years been associated with the switch department of Messrs. Ferranti, Ltd., has resigned his position of chief draughtsman with them, in order to take up the management of the works and drawing office of Messrs. Lionel Robinson & Co., Ltd., Ferry Works, Thames Ditton.

The Hon. George Peel, a director, and Mr. F. E. Hesse, the general manager of the Eastern Extension Telegraph Co., left London on Wednesday last to visit the company's stations abroad.

London County Council.—At the last meeting it was decided to sanction the loan of £849 to the Islington Borough Council for mains, and £6,040 to the St. Pancras Council for electric lighting purposes.

The adjourned report of the Highways Committee was submitted in reference to the rebuilding of car-sheds at the Streatham depôt in connection with the projected conversion of the Brixton cable line to the electric conduit system at an early date. An expenditure of £35,000 was approved for providing accommodation for 82 single-truck cars, and the sum of £91,030 was also allocated to the erection of the superstructure of car-sheds required at the New Cross depôt.

The Highways Committee reminded the Council of the acceptance of the tenders of the British Westinghouse Electric Co. last April for the supply of 200 cars for the New Cross and Greenwich tramways. A large number of the cars had already been supplied, and a further quantity were ready for delivery, but the Council had no car-shed accommodation for them, although the contracts contemplated the acceptance of the cars by now. In these circumstances, and in view of the fact that the car bodies occupy considerable space at the works, the contractors had asked that certain payments should be made on account of work completed but not delivered. The Committee considered the request to be reasonable, and recommended the Council to accede to it.

Smoke Abatement.—The Willesden District Council recently summoned the Metropolitan Electric Supply Co. for black smoke nuisance from their chimney shafts in Acton Lane.

Mr. Muir, for the defence, argued that what in the Smoke Abatement Society's chart is black and dense black was merely light and moderate grey respectively. He also alleged discrepancies in the times adduced by witnesses, and said that the company had high chimneys and stoking appliances and grates that obviated smoke emission, £700 being spent this year for the latter purpose, and two assistant engineers being appointed since July with the sole duty to minimise smoke from the furnaces.

Mr. J. S. Highfield bore out these statements as chief engineer to the company. They had, he said, 44 boilers, 20 hand stoked, eight with Vicars's appliances and the remainder chain grates. They tested all coal and rejected that with unusual smoke, and though in getting up steam quickly by hand stoking, they caused smoke, it was not black smoke.

Mr. James Swinburne stated that the Smoke Society's chart omitted black smoke. In giving judgment, the chairman said on the offence alleged on September 16th they determined to convict. They imposed a fine of £5, made an order to abate the nuisance and prohibit its occurrence. They awarded the Council £20 costs. Mr. Muir said his clients would appeal to Quarter Sessions, and the recognisance for the appeal was fixed at £20.

The Speed of Electric Cars.—The case of the L.U.T. drivers, involving excessive speed charges, recently further occupied the West London Court. Evidence was given by Prof. Silvanus Thompson, who stated that since the last hearing he had made a careful examination of the company's mechanical and electrical plant and of the four cars, and he had made four speed tests of each of the cars over the measured furlong used in Colonel Purcell's tests. The mean speeds attained by the cars were as follows:—Car No. 272, 14·465 miles per hour; No. 60, 12·487 miles; No. 75, 13·335 miles; No. 173, 14·157 miles. When he made these tests he had a voltmeter on the cars, and he was satisfied that the conditions under which the tests were made were fair, and that there had been no tampering of any sort or kind with the electrical plant or with the cars. In his judgment it was not possible for any of these cars to go at 17 miles per hour on the section of line referred to. In cross-examination (says the *Times* account) Prof. Thompson said it was not necessary to use a voltmeter for tests of speed; the use of a voltmeter was only necessary when, as at the last hearing of this case, suggestions of fraud were made. Asked whether Mr. Evershed (who gave evidence for the prosecution at the former hearing) was an electrical authority, Prof. Thompson said Mr. Evershed was an electrical instrument maker; among other things he made speed indicators. Further evidence having been given, Mr. Rose said it was clear that the methods by which Mr. Ford took the speeds which were the subject of the summonses were not so exact and accurate that he could have relied upon them if it had been alleged that the regulation speed per hour had been exceeded by, say, a quarter of a mile per hour, and if Mr. Muir could have shown conclusively that the cars could not have attained a greater speed than 13 miles an hour, then he would have been obliged to come to the conclusion that Mr. Ford's experiments must be entirely disregarded. But, after hearing all the scientific evidence, he was not so satisfied of Mr. Ford's gross inaccuracy as to doubt his statement that the speed of the cars exceeded 10 miles an hour, although it appeared to be practically impossible that the cars could have attained the very high speeds which Mr. Ford alleged. And if the speed exceeded 10 miles an hour there must be a fine. As to the amount of the fine, motorists would no doubt think that the same fine as they usually had to pay ought to be imposed on this great company; but it was not the company that was summoned, but the drivers, and he would impose fines of £2 each. Mr. Muir, who appeared for the company, said that Mr. Ford had in the course of the case made a deliberate suggestion of fraud against the company in connection with the tests, and he hoped the magistrate would express his opinion on that point. Mr. Rose said he did not regard it as a suggestion of fraud. Mr. Ford said he had not intended to make such a suggestion; if he had made it he withdrew it.

Wind-driven Electricity Works.—The problem of using wind power in connection with electricity works has often been investigated, the principal drawback being the variable strength of the wind, resulting in corresponding variations in the speed of the dynamo. This difficulty, however, has, it appears, recently been solved by Prof. La Cour, who, on behalf of the Danish Government, has for some years past been engaged in studying the question. In order to impart to the motor an approximately continuous speed independently of the strength of the wind, Prof. La Cour, as pointed out in a lecture delivered before the recent Copenhagen Technical and Sanitary Congress, uses an intermediate shaft placed in connection with a balance. The belt from the mill is led vertically on the disc of this shaft, its pressure on the latter being regulated by the balance bearing convenient counter-weights. This arrangement results in the belt sliding on the disc as soon as the load exceeds a given maximum. A plant of this kind, feeding about 450 incandescent lamps, has for nearly a year been in operation at Askov, Denmark, petroleum motors serving as a reserve in case of several days' calm. The constant normal current with this works is 50 amperes, and the distribution pressure 2 × 110 volts. This plant has so far worked with satisfactory results, and required no supervision worth speaking of. As regards the economical side of the question, a similar plant has been found to pay very well, the first cost being about 16,000 kr., out of which 3,000 kr. correspond to the petroleum motor. The current is supplied to consumers at the same price as in Copenhagen, *i.e.*, at the rate of 50 öre per KW.-hour for lighting and 15 öre for power purposes. The receipts for energy sold have been about 2,800 kr. and the expenses about 800 kr. per year. There thus remain 2,000 kr. profit, a sum more than sufficient for a capital of 16,000. The price of the energy could, therefore, be further diminished. In the case of very small electricity works intended for the use of a limited number of houses, the petroleum motor may advantageously be replaced by a horse-driven contrivance. Moreover, in the case of the proprietor of the works being his own consumer, the consumption of energy may be regulated according to the actual supply of wind, the cost of the plant thus being further diminished.—*Engineer.*

Marriages.—Mr. Walter Robb, of Messrs. Robb and Mitchell, electrical engineers, of Ossett, was married the other day at Horbury Bridge to Miss Gertrude Quarmby.

The marriage of Miss Edith Ayrton, daughter of Prof. W. E. Ayrton, to Mr. Israel Zangwill, the well-known author, was to be solemnised yesterday in London.

A Suggested Hydraulic Unit.—At the September meeting of the American Institute of Electrical Engineers, Mr. Ralph Montagu suggested the creation of a new unit for the measurement of water power. There is at present in use on the slope a unit of measurement of the flow of water known as the "miner's inch." The legal definition of the means of measuring this volume varies so much in different States, that the actual flow of legal miners' inches is from 1·36 to 1·73 cb. ft. of water per minute. For this reason a miner's inch, unless the cb. ft. flow per minute that it represents is specified, can be dispensed with. On the other hand, formulæ relating to horse-power of water are based on the number of cubic feet of water per minute, or gallons, under a certain head; that is, the vertical distance of fall. Mr. Montagu suggested that a new unit composed of 1 cb. ft. of water per minute under 1 foot-head be recognised, and a name for it suggested by the Institute. This unit would equal 62·3808 ft.-lbs., or 0·00189 H.P., or 1·40994 watts. In the discussion of Mr. Montagu's paper, Mr. C. O. Mailloux said he considered that the author had performed a service, not so much in suggesting the adoption of a new unit of measurement, but rather because he unconsciously showed quite forcibly an additional good reason why we should adopt and use the metric system. According to the metric system, a cubic metre of pure water (or, for practical purposes, clean water), weighs 1,000 kgm., or a "metric ton," while a cubic decimetre of water, being the thousandth part of a cubic metre, weighs exactly 1 kgm. Again, 75 kgm.-metres per second equal one "metric" horse-power, while 76 kgm.-metres per second equal one "English" or "American" horse-power (33,000 ft.-lbs. per minute, or 550 ft.-lbs. per second). With these data, we have all that is necessary to enable us to make readily and quickly any calculations whatever relating to water power. We have our horse-power unit already, and it is the same for water power as for steam power, namely, 75 kgm.-metres per second direct; and, if we divide that product by 75, we have the result at once in metric horse-power. If we divide it by 76, we have the result in standard American horse-powers, each equal to 33,000 ft.-lbs. per minute. Further, the kilowatt is equal in round numbers to 100 kgm.-metres per second (101·8 to be exact). It would appear, therefore, that if the French *savants* appointed at the time of the French Revolution, over 110 years ago, had sought to devise a system intended to be of special use in water-power

measurements, they could scarcely have done it more successfully. In conclusion, Mr. Mailloux thought it would be a much more sensible thing to adopt the metric system, in which there is a well-defined ratio between the specific gravity of water, and measurements of length, area and volume, than to attempt to patch up an antiquated system by adding units which are only names for a string of figures.

Electric Railway Possibilities in South Africa.—Our New York namesake publishes the following interesting comments from the report of Mr. Hoy, the chief traffic manager of the Central South African Railways:—"The success with which heavy locomotive engines are now being employed in these colonies, as well as in England, points to the maximum having been nearly, if not actually, reached. A 120-ton locomotive upon an 80-lb. rail, on a 3 ft. 6 in. gauge, is what would generally be considered a favourable result. If the locomotive limit has been attained, there are evidences of developments in substituting a newer motive power upon lines where the nature of the traffic to be conveyed renders it possible to utilise electrical or other systems of energy. The employment of the heavy locomotive has its unquestioned economic merits, but it is an important consideration whether freight vehicles may not with advantage be equipped with their own motive power, either for individual or collective haulage. The grade will always largely influence the value of the locomotive, but upon sections admirably adapted for the use of electricity the adhesive power may with advantage be abandoned for the energy attached to the vehicle itself, and thus overcome the resistance common to the present system of haulage. Whether the power to be employed be electricity or a combination of other forces, there can no longer be any doubts that upon short and busy lines steam can be superseded. If any section of railway in South Africa lends itself for advancement in this direction, the Springs-Randfontein length offers an admirable opportunity for the expansion of such scientific energy. The working of so many mines sidings might assure the success of a change in working. There is a further guarantee of sufficient traffic within the section. I assume that electricity will supersede steam for passenger work along what is known as the Rand tram section within a measurable space of time. There are excellent opportunities for installing electricity, and of taking early steps, not only to cultivate the suburban traffic, but to retain it."

Circular and Figure 8 Trolley Wire Combined.—"Figure 8" wire is finding favour fast in the U.S., and with good reason, as, however well-made the ear, and however neatly that is attached to the trolley wire, the trolley wheels jump and the current arcs as often as a wheel and an ear meet at high-speed on a plain circular trolley wire. Roads speeding up their cars and not desiring to scrap their low-speed overhead construction, or roads unwilling to pay for figure 8 wire, or not caring to handle it, have its obvious advantages at their call if they take heed of the information contained in the letter of a correspondent of the *Street Railway Journal* for August 8th. All there is to it consists in constructing a hydraulic or oil die-press working up to about 2 tons, that can be taken to the top of a tower-wagon, and there used to squeeze out, by means of suitable dies, a groove some 4½ in. long on each side of the wire, directly under the point of suspension. The grooves are made a little above the horizontal diameter of the wire, and permit the use of a standard figure 8 clamping ear. It is stated that this ingenious method has been used on two city lines with satisfactory results over a period of several months; and if a more extended trial proves altogether favourable, we should strongly urge engineers at home to go carefully into the matter for themselves. The advantages of a perfectly smooth-running wire should be sought eagerly by anyone who has a real appreciation of the shortened life of circular wire subjected to constant blows from hurrying trolleys, which hurry faster and collect heavier currents year by year. The increased life of the trolley wheels, too, is an item worth some consideration. We believe specially-rolled figure 8 wire to be more difficult to handle than circular wire, and heavier price has to be paid for the whole length of wire, while its special feature is required only for about $\frac{1}{250}$th part of its length. The method to which attention is called provides the special section only where it is wanted, and can be applied to any existing line using as small as single-nought wire at the cost of new and lighter ears, and the necessary labour for operating the press. The heavier the wire, the safer the alteration should be.

Institution of Electrical Engineers (Birmingham).—The opening meeting of this Section has been further postponed from December 2nd to December 3rd.

Royal Society.—Among the papers down for reading yesterday was one by Mr. T. C. Porter on "Some Experiments in Magnetism." (Communicated by Lord Rayleigh, O.M., F.R.S.)

THE CENTRAL STATION ENGINEER.

On 19th inst. the staff of the Sheffield electric supply department presented Mr. T. J. Ballard with a case of cutlery and a "round robin," designed by Mr. Fedden, showing a section of a 3-core armoured cable suitably inscribed, and gave him a hearty send-off to his new appointment as resident engineer at Aston Manor. Mr. Fedden made the presentation.

Mr. Carr, assistant electrical engineer at Maidstone, has been appointed resident electrical engineer at Leek.

NEW COMPANIES REGISTERED.

Electrical Turnery, Ltd. (79,195).—This company was registered on November 20th, with a capital of £2,000 in £1 shares, to adopt an agreement between Electrical Turnery, Ltd., of the first part, T. H. Cramp, the liquidator thereof, of the second part, A. G. Scott (for this company) of the third part, and H. Wyman of the fourth part, and to carry on the business of turners of wood, ivory, bone, metal and other materials, pattern makers, founders, cabinet makers, carpenters, joiners, fitters, telegraph, telephone, electric and general engineers, manufacturers of and dealers in electrical and other bells, telephones, lamps and apparatus, &c. The principal subscribers are:—J. H. Maunder, Hilltop, Belmont Park, Lee, S.E., musical composer, 150 shares; C. F. Quicke, 17, Courthorpe Road, Haverstock Hill, N.W., consulting engineer, 50 shares; J. Connolly, 5, Wilton Polygon, Cheetham Hill, Manchester, electrician, 70 shares; A. G. Scott, 28, Portland Road, Southall, showroom manager, 60 shares; C. F. Freedman, 11B, Grand Parade Mansions, Highgate, N., works manager, 60 shares; T. White, 57, Highbury Hill, N., electrical engineer, 150 shares; A. Jaray, 39, Granville Gardens, W., electrical engineer, 60 shares; and H. Wyman, 24, Crescent Road, Bromley, Kent, filter merchant, 250 shares. No initial public issue. The number of directors is not to be less than three nor more than seven; the first are C. H. Freedman, A. Jaray, J. H. Maunder, C. F. Quicke, A. G. Scott and H. Wyman; qualification, £100; remuneration, one guinea for the chairman, and 10s. 6d. each ordinary director per board meeting attended (maximum per annum, 26 guineas for chairman and 13 guineas each for ordinary directors).

British Accumulators Co., Ltd. (79,191).—This company was registered on November 20th, with a capital of £5,000 in £1 shares, to acquire as a going concern the business of electric accumulator sellers and merchants, as now carried on as the British Accumulator Co., at Parliament Mansions, Westminster, and the right to sell in the United Kingdom and Colonies electric accumulators either wholly or partly manufactured by the Allgemeine Accumulatorenwerke Actiengesellschaft, in Vienna, and to carry on the business of manufacturers and vendors of electrical accumulators, and all other articles used in connection with lighting and accessories thereto. The first subscribers (each with one share) are:—J. Halcrow, 5, Moorgate St. Buildings, E.C., merchant; T. Niemeyer, 5, Moorgate St. Buildings, E.C., merchant; G. A. Dawson, 5, Moorgate St. Buildings, E.C., clerk; W. Smith, Moorgate Station Chambers, E.C., secretary; F. Von Gerson, 20, St. James Place, London, civil engineer; H. J. Godfrey, Luscombe, Presburg Road, New Malden, clerk; and H. D. Parsons, 40, Leighton Grove, Kentish Town, N., clerk. No initial public issue. The number of directors is not to be less than five nor more than eight; the first are A. Lederer, E. Lederer, J. Lederer, M. Pal and F. von Gerson; qualification, 50 ordinary shares; remuneration (except managing director), £100 per annum, divisible.

Archibald J. Wright, Ltd. (79,117).—This company was registered on November 13th, with a capital of £3,000 in £1 shares, to adopt an agreement with A. J. Wright for the acquisition of the business carried on by him at 318, Upper Street, Islington, and to carry on the business of electrical and mechanical engineers, merchants, and manufacturers of and dealers in electric, magnetic, telegraphic, telephonic, photographic and other appliances and apparatus, cycle and motor-car manufacturers, &c. The first subscribers (each with one share) are:—A. J. Wright, 33, Aberdeen Road, Highbury, N., electrician; Mrs. F. M. Wright, 33, Aberdeen Road, Highbury, N.; A. R. Skeet, 2, Greenham Road, Muswell Hill, N., agent; Mrs. E. Skeet, 2, Greenham Road, Muswell Hill, N.; L. Stoer, 168, Albion Road, Stoke Newington, N., electrical engineer; H. Woodward, 29, Prebend Road, Islington, N., mechanical engineer; and G. R. Reid, 4, Castle Court, Birchin Lane, E.C., solicitor. No initial public issue. A. J. Wright is the first chairman and managing director with £208 per annum.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Central Electric Supply Co., Ltd. (53,080).—An instrument of charge under the Land Transfer Acts, 1875 and 1897, dated November 2nd, 1903, supplemental to a trust deed dated July 2nd, 1901, and an acknowledgment of indebtedness dated June 10th, 1903, to securing in the aggregate £300,000 debenture stock, has been registered. Property charged: Part of land in Marylebone comprised in title 44,393 registered under the Land Transfer Acts. Trustees: Hon. A. Lyttleton, K.C., 3, Paper Buildings, Temple; and W. H. Fisher, M.P., 13, Buckingham Palace Gardens, S.W.

Fladbury Electric Light and Power Co., Ltd. (63,962).—Issue, on October 31st, of £150 debentures, part of series created same date to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Sharpe & Co., Ltd., electrical and general engineers, Grimsby.—Issue, on October 24th, of £500 debentures, part of series created December 14th, 1899, to secure £2,500, charged on all the company's property, present and future, including uncalled capital. No trustees. Previously issued of same series: £500.

South African Lighting Association, Ltd. (27,609).—Re-issue, on October 28th, of £580, on November 11th of £270, and on November 13th of £150 debentures, part of series created August 12th, 1890, to secure £20,000, charged on the company's undertaking and real and personal property. Holders: Miss A. M. Johnson, Harmlake House, Sutton Vallance, near Maidstone, Kent: H. A. Plumb, W. A. Stone and W. A. Stone, 90, Cannon Street, E.C.; S. Cutler, Westbank, Lewisham Hill, S.E.; and Miss L. M. Stone, Brooksend, Birchington-on-Sea. No trustees. Previously issued of same series: £20,000.

ELECTRICITY SUPPLY ACCOUNTS.

Hanley Municipal Electricity Supply.

The last yearly returns of the Hanley electricity department exhibit several satisfactory features. An increase in revenue of £1,100 was earned, with a working expenditure of some £700 less than in the previous year, the gross profit improving to that extent.

In contrast to the majority of electricity supplies, the average revenue per unit sold improves each year. Of the 752,439 units sold, public lighting took 160,558 units, as compared with 151,051 last year.

The prices charged are:—For private lighting, 6d. and 3d.; and for heat and power, 3d. and 1d. per unit on the maximum demand system; churches, &c., 4½d. per unit, with discount. The borough electrical engineer is Mr. C. A. Cowell.

GENERAL STATEMENT.

For year ending December 31st—	1902.	1901.
Total capital expended	£81,940	£79,882
Number of units sold	752,439	697,602
Equivalent No. of 8-C.P. lamps connected	50,872	46,300
Number of public lamps	262	169
Maximum load in KW.	740 KW.	677 KW.
Revenue account—		
Gross revenue	£13,963	£12,866
„ expenditure	£7,824	£8,514
„ profit	£6,139	£4,352
Average price obtained per unit—		
Private lighting...	4·65d.	4·65d.
Public lighting	3·27d.	3·12d.

REVENUE STATEMENT.

	1902. Gross.	1902. Per unit.	1901. Per unit.	Inc.
By sale of energy	£13,557	4·33d.	4·30d.	·03d.
Meter rents and sale of apparatus	406	·13d.	·12d.	·01d.
Gross revenue ...	£13,963	4·46d.	4·42d.	·04d.

COST OF PRODUCTION.

For year ending December 31st—	1902. Gross.	1902. Per unit.	1901. Per unit.	Inc.
Coal, &c	£2,086	·67d.	1·04d.	—·37d.
Oil, waste, water and engine room stores ..	409	·13d.	·16d.	—·03d.
Wages incurred in generation and distribution	1,012	·32d.	·37d.	—·05d.
Repairs and maintenance of buildings, engines, boilers, dynamos, other machinery, instruments, tools, mains, &c.	1,952	·62d.	·61d.	+·01d.
Works and distribution costs	£5,459	1·74d.	2·18d.	—·44d.
Public lighting, repairs and attendance ..	585	·19d.	·16d.	+·03d.
Rent, rates and taxes	817	·26d.	·28d.	—·02d.
Management expenses, salaries of engineer and clerical staff, stationery, printing, general establishment charges, law charges, insurance, &c.	963	·31d.	·30d.	+·01d.
Total works cost	£7,824	2·50d.	2·92d.	—·42d.

PROFIT STATEMENT.

	1902.	1901.
Interest on loans, &c.	£2,480	£2,156
Sinking fund, &c.	2,498	2,148
Sum applied in relief of rates	1,200	—
Balance on year's working carried forward	61	48
Gross profit	£6,139	£4,352

Consequent on the improved returns, the department, after meeting financial charges, had a balance in hand for the year amounting to some £1,260, as compared with £48 last year, and debit balances for some years previous. After placing a sum of £1,200 to the local rates, the total balance in hand amounts to £109.

CITY NOTES.

Eastern Extension, Australasian and China Telegraph Co.

THE sixtieth half-yearly meeting of the shareholders of this company was held on Wednesday, November 18th, at River Plate House, Finsbury Circus, Sir J. Wolfe Barry presiding.

The CHAIRMAN, in moving the adoption of the report, said that the gross revenue for the half-year had amounted to £265,000, against £283,000 for the corresponding period of 1902, showing a decrease of £18,757. The actual falling off in receipts from the Australasian traffic amounted to £31,000 in round figures, but fortunately many of the local traffics showed substantial increases. The working expenses had amounted to £138,000, against £121,000, showing an increase of £17,000. Maintenance of cables accounted for £2,000 of that increase, but the bulk of the increase, like the decrease in revenue, was due to the keen and what he thought he might, without qualification, call the unfair competition which they were experiencing at the hands of the Governments of Great Britain, Canada and Australia in the Australasian traffic. In order to meet that competition by being in a position to fulfil every telegraphic need of the Australians, and in order to obtain a more central position in Australia, they, in conjunction with the Eastern Co., laid a few years ago, at a very heavy cost, the Cape-Australian cable which not only gave them direct telegraphic communication with the cities of Perth and Adelaide, but obtained for them direct dealings with the public in those and in other State capitals of Australia, together with the use of the Government wires between Adelaide, Sydney and Melbourne for the transmission of the traffic by their own employés. Although the privilege of dealing with the public was readily granted to private companies, both foreign and English, in Great Britain, Canada and many other countries, the Governments of Canada, New Zealand and Queensland, strongly objected to their enjoying it in Australia, and had protested against the Federal Government's decision to extend the company's privilege to Melbourne and Brisbane As a result of those protests, their new agreement with the Federal Government, though ratified by the House of Representives without a division, still awaited the decision of the Senate, which was delayed until after a conference had been held of the Pacific cable partners. That conference was expected to take place either in London or Australia very shortly. Meanwhile the competition between their cable and the Government cable was being conducted as actively and keenly as possible on both sides, and although they had to complain of unfair treatment by all the Governments, they had, so far, been successful in retaining quite as large a proportion of the traffic as they expected to do under the circumstances. He noticed a statement in the daily papers to the effect that the working of the Pacific cable was much quicker than that of the Australian, messages having taken only 25 minutes *vid* the Pacific against three hours by their route. By selecting the most favourable conditions for the Pacific route and the most unfavourable for the company's route, it was, of course, very easy to show those striking differences, but had Adelaide and Perth been selected as the Australian termini instead of Christchurch and Brisbane, as was evidently the case, the result would probably have been different. Many of their messages were transmitted from Perth and Adelaide in a few minutes. A message announcing the result of the first race for the American Cup took only four minutes between London and Australia by their route against three hours by the Pacific route. A later cup race telegram only took three minutes. But all those comparisons were more or less misleading, and the only fair comparison of any real value was to take the average time of the whole traffic by their route spread over a given period. The best test was the attitude of the telegraphing public, who would not continue to give them the bulk of their traffic unless their route was perfectly satisfactory, especially in face of the sentimental and other appeals made to them by and on behalf of the Governments interested in the Pacific cable. That competition, of course, involved considerable expenditure, and accounted for the increase in their working expenses. He ventured to say that, whilst seriously injuring their interests, the Pacific cable had not benefited the British or Australian public or any of its promoters. The rates charged were not lower than those agreed to be charged by the Australian companies in connection with the new cable *vid* the Cape. The only country that would at all benefit was the United States, as the traffic with Canada was very small. He saw that there would be a deficit on the working for the current year of nearly £100,000, which would have to be borne by the taxpayers of the Governments interested, which went to prove what he had often said, that the Australian traffic was not sufficient to support all the existing cables, and that the Pacific cable was never needed for any traffic arrangements. The cable connections with Australia were far in excess of any traffic likely to be developed for many years to come. It was a most unfortunate thing that a commercial company like theirs should have been exposed to Government competition conducted with public money, to the great detriment and discouragement of private enterprise. All the great developments in the past had been the result of private enterprise, and if Governments were to embark upon the policy of systematically crushing private enterprise, they would not only be doing no good to the taxpayer, but serious harm to the country at large. The company had still to meet that competition, but he was pleased to know that the drought from which Australia had so long suffered had passed away, so that they might naturally expect that the business of the country would increase. The contract with the Dutch Government for supplying and laying cables on their behalf between Borneo and the Celebes had been successfully carried out, and a further contract had since been entered into for supplying and laying some additional short cables in the Java seas. The Commercial Pacific Co.'s cable between San Francisco and Honolulu had been extended to Manila, and an arrangement had been come to with that company by which not only was the United States directly connected with the Far East, but the Eastern Extension Co. had secured another alternative route to Europe, which ought to bring a substantial development of traffic from time to time. Including the balance brought forward, the net profit for the half-year amounted to £146,036, out of which interim dividends at the rate of 5 per cent. had been paid, absorbing £75,000, leaving a balance of £71,036 to be carried forward to the next account.

The report was adopted.

Power Gas Corporation.

THE report for the year ended September 30th last states that the extension and remodelling of the works at Stockton-on-Tees, referred to in the last report, have, during the year, been completed on the most modern lines, and the cost is included in the amount of the advance to Ashmore, Benson, Pease & Co., Ltd., £115,036. New contracts of considerable value have been secured for the installation of power gas plant, both in this country and abroad, and also contracts for the extension of existing installations under the corporation's patents. Satisfactory progress has been made during the past year with the contract for the gas generating and distributing plant for the South Staffordshire Mond Gas Co.'s first central station, which, it is expected, will be completed during next year. An Act of Parliament has been obtained during the past session conferring powers for the distribution of electricity and power gas throughout North Staffordshire and parts of the counties of Derby, Flint and Denbigh. The directors have agreed to grant a license upon satisfactory terms for the sale and distribution throughout that area of power gas manufactured under the patents of the Power Gas Corporation. The corporation has acquired the sole rights in this country for the manufacture and sale of the appliances patented by Mr. Benjamin Talbot for mechanically agitating the fuel in gas producers. The directors have appointed Mr. Benjamin Talbot a director, and his appointment will come before the general meeting

for confirmation. The balance-sheet shows a balance to credit of profit and loss account of £13,082. The amount written off preliminary expenses account is £2,000. A dividend at 5 per cent. per annum upon the ordinary shares is recommended, and the balance to be carried forward is £1,693.

Cape Electric Tramways, Ltd.

Col. Sir Charles Euan Smith, K.C.B., presided at No. 1, London Wall Buildings on Wednesday, November 18th, over the seventh ordinary general meeting of the above company.

In moving the adoption of the report, the Chairman said the shareholders would find in it gratifying proof that their tramway systems at Cape Town and Port Elizabeth continued to exhibit that steady progress as to traffic and revenue which might be regarded as one of the most solid symptoms of stability and success. Notwithstanding the large increases that, since the first commencement of the working, had characterised the traffic and revenue of each successive year, the period under review exhibited a still further increase of £15,837 in the gross revenue, and of 1,245,000 passengers carried as compared with the preceding year, and these results had been obtained notwithstanding the prognostications made by so many that the cessation of the war would be the signal for a large exodus of those temporary residents in Cape Town and Port Elizabeth brought thither by the war and for a corresponding decrease in the revenue. The contrary had proved to be the case. It was true that the operating expenditure for the 12 months had proved very heavy, and that the net profit was lower than that of the preceding year by some £15,000, but this was due to causes which were quite unavoidable, and against which no foresight on their part could have protected them. The great strain on the rolling stock and permanent way for the sudden heavy development of the traffic during the war had rendered a complete overhauling of the permanent way of the rolling stock, and of the plant in Cape Town imperatively necessary. And all this in conjunction with the erection of additional power plant and of a fresh rolling stock had had to be carried out at a time when rates for both skilled and unskilled labour and all prices were, as they had since remained, abnormally high. This abnormal expenditure, however, was now gradually diminishing, though much still remained to be done to the permanent way, and these reductions would, it was hoped, further make themselves felt during the current year. In the meantime they had the satisfaction of knowing that the plant in Cape Town was efficient and equal to the requirements of the traffic. In Port Elizabeth they had nearly completed the erection of an additional unit in the power house, and had added to the rolling stock, bringing it up to the level of the traffic requirements. It must be remembered that the increased expenditure on these most necessary works had been provided without their having had recourse to any measures providing for a further increase of capital. The excess of their expenditure over the original estimates, for which funds had been provided had been met from the reserve fund, which now stood at £137,000, and notwithstanding the decrease in the net profit available for dividend, the net result to the shareholders was that they had received 12 per cent., free of income-tax, on the year's working. The board regarded this as highly satisfactory, coupled as it was with increased efficiency in the plant and rolling stock. It was true that the board had not found it possible as on the two preceding years to recommend any distribution of a further sum in the nature of a bonus, but it must be remembered that on each of those occasions a note of warning was sounded that the distribution must necessarily be regarded as of an exceptional character, that might at any time have to be suspended. These warnings had been justified by events which were partially foreseen by the directors. With regard to the lease of the Camps Bay Tramways he might say that the directors in accepting the lease were quite prepared for a certain initial loss in the early stages of operating the system, but they were nevertheless satisfied with the terms that were arranged, including as they did the option of purchase of the Camp Bay Tramway system with its Parliamentary concession of 50 years. After lengthy negotiations with the Cape Town Municipality they had been able to get amended bye-laws containing wholesome modifications on the regulations passed in 1901 against over-crowding of cars. The regulations now allowed nine passengers to occupy standing room on each car.

Mr. Ludwig Breitmeyer seconded the motion, which was carried.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—Great Northern and City Railway Co.—78,000 deferred ordinary class "B" shares of £10 each, fully paid, Nos. 1 to 78,000; and to allow the following to be quoted in the Official List:—British Columbia Electric Railway Co., Ltd.—Further issue of 1,500 5 per cent. cumulative perpetual preference shares of £10 each, fully paid, Nos. 51,001 to 52,500.

British Aluminium Co.—Mr. J. D. Bonner presided at an extraordinary general meeting held at Winchester House, E.C., on Friday last, when the resolution reducing the capital passed at the meeting held on November 4th was confirmed as a special resolution.

R. Hornsby & Sons, Ltd.—Dividend of 6 per cent. per annum on preference stock for the half-year, and 8s. each on the ordinary shares, making 5 per cent. for the year, placing £5,000 to reserve fund and carrying £1,443 forward.

STOCKS AND SHARES.

Wednesday Evening.

That brightness of reviving business in the Stock Exchange to which we drew attention last week, continues to make itself felt in many of the markets. Speculation has sprung into fresh life in the Kaffir Circus, and the better tone developed thereby is considered a happy omen that the House may even yet enjoy a Christmas made merrier by altered conditions as regards business. Money remains plentiful, but Consols are on the eve of their monthly settlement, which rather tends to keep the quotation down. Home Railway stocks advanced into favour early this week, and a small rise in Metropolitans has again to be recorded.

Central London Railway stocks are a dull market, receiving no encouragement whatever from the higher aspirations of the steam varieties. The Ordinary has fallen 2, and the Deferred 3 points this week as usual, upon the Metropolitan electrification fears. Nor does the decline seem to tempt buyers, although in view of the probable 4 per cent. to be paid on the stocks in January the quotations begin to look reasonably cheap. There is an impression gaining ground that the Deferred and Ordinary may have to go shorter this year as regards the dividend, but the idea seems to be fostered by the fall rather than the other way round.

City and South London at 51, and Waterloo and City at 92½ keep steady, but Metropolitan Consolidated has been actively good, and the price on Wednesday evening is 87, some 3 points up this week. The stock is in short supply, and several of the dealers were caught bears of it. Districts are also higher at 32, in sympathy with the Metropolitan advance. East London has been done at 4¾, but Mersey Ordinary is neglected at about 9½—the stupidly wide quotation in the Official List being 8 to 11.

Amongst Traction descriptions, British Electric Traction are again unaltered, and there is not much doing in leither class of shares. London United Preference have given way ¼ to 11½, the Ordinary to 18¼, while the Debenture stock is 105. Can there be a new issue coming? Potteries are 9 for Ordinary and Preference, Dublins 12½ and 15½ for the two kinds respectively. Calcutta trams continue to be done at about 7, and the Debenture stock marks 106¼ this week. Anglo-Argentine 6 per cent. Debenture stock changed hands at 126¾ and 128½, the shares remaining at 4⅝. A few transactions have taken place in the Belgrano issues, upon the sustained attention devoted to all kinds of traction in the Argentine Republic. The "A" Preference are 5½, and the "B" 5. The 5 per cent. Debenture stock was sold a few days ago at 106.

Interest attaches to the electricity supply section from the extension of the time for redemption of Edmundson's Debenture stock until 1935. Previously the date of redemption had been 1913, and the change should improve the quotation of the security, although it shows no improvement yet. County First Debenture has risen a point, and is now 4 per cent. higher than the Edmundson's issue, although County Ordinary shares stand at a substantial discount, whereas Edmundson's Ordinary are about 30s. premium. St. James's Preference fell ¼ upon the appearance of a seller at 8, and Metropolitans are 10s., better. Brush Ordinary are being dealt in at a sovereign, and the Preference at 25s. London Electric Preference have recovered their slight fall of last week, but South Londons are 5s. down, and Westminster Ordinary twice that amount. Despite the attention constantly called to the Electric Supply market by financial writers in the Press, this investment section continues to be treated with a neglect that is surprising in view of the good yields and good security that are offered by Supply shares. It has to be remembered, too, that in many cases the quotations carry four or five months' dividend.

Coming to Telegraphs, Globe Ordinary has fallen ¼, and in that movement is reflected the general dulness of this market, although prices show very little change. Anglo-American Deferred has fidgetted up ¼ again, and Submarine Certificates are a dollar better. Great Northerns have risen 10s. In the Eastern group, a 1 per cent. decline in Eastern 3½ per cent. Preference forms the only fluctuation. Those interested in this market are humorously regretful that the All-British Cable should have got in just ahead of the Eastern Telegraph Co. in reporting the result of one of the Australian cricket matches; but the tables may be turned next time.

National Telephone Deferred has shot up 5 points, and now stands at 80. As there was no valid reason for the former acute depression, the present advance is attributable largely to reaction, while rumour runs that the company is doing an exceedingly good business. If this be the case, as it seems likely enough to be, the Post Office Telephone authorities have only themselves to thank. National Telephone First Debenture has gained another point, and the Third Preference shares at 5½ show a rise of the fraction.

In the manufacturing division, British Insulated Debenture stock is up to 105½, a rise of two points, while Telegraph Construction Debenture has also hardened. The shares in this company are quoted officially at 34 to 37; actually, the price is more like 34 to 34½, another instance of misleading absurdity. British Westinghouse Preference at 5½ have not moved on the week; some people are wondering why the dividend declaration is being delayed this year.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations Nov. 18th.	Closing Quotations Nov. 25th.	Business done week ended Nov. 25th, 1903. Highest	Lowest.
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	99 —103	99 —103	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2¼ — 3¼	2¼ — 3¼	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	70 — 80	70 — 80	..	..
788,840	Anglo-American Telegraph	Stock	3½%	61s.	60/6	49 — 52	49 — 52	49½	49½
3,105,580	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	92 — 94	92 — 94	93½	93
3,105,580	Do. do. do. Deferred	Stock	5s. %	2s.	1/-	7⅜ — 8⅛	8 — 8⅛	8 1/16	8
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	5 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..
18,888,800$	Commercial Cable	$100	8 %	8 %	8 %	145 —155	145 —155	..	..
1,841,909	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	90 — 93	90 — 93	91¾	90½
16,000	Cuba Telegraph	10	4½%	4 %	6½%	7 — 8	7 — 8	..	..
6,000	Do. 10 % Pref.	10	..	..	..	16 — 17	16 — 17	16	..
12,981	Direct Spanish Telegraph	5	4 %	4 %	4 %	2½ — 3½	2½ — 3½	..	..
6,000	Do. do. 10 % Cum. Pref.	5	..	..	..	7 — 8	7 — 8	..	..
80,000	Do. do. 4½ % Debs.	50	..	..	..	97 —101	97 —101	..	..
60,710£	Direct United States Cable	20	3½%	3½%	3½%	10½ — 10¾	10½ — 10¾	10⅝	10½
97,800	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,200, Red.	100	..	..	..	99 —102	99 —102	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	122 —127	122 —127	124½	122
1,955,555	Do. 8½ % Pref. Stock	100	..	..	..	85 — 88	84 — 87	84¼	..
1,584,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	105 —108	105 —108	105¾	..
800,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	11 — 11½	11¼ — 12	11¾	11 5/16
800,000£	Do. 4 % Deb. Stock	Stock	..	..	..	105 —108	105 —108	..	..
800,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 8,000, red. 1909	100	..	..	..	99 —102	99 —102	..	..
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	99 —102	99 —102	..	..
180,227	Globe Telegraph and Trust	10	5½%	5½%	..	8½ — 9	8½ — 8¾	8¾	8¼
180,042	Do. do. 6 % Pref.	10	..	..	..	12½ — 13	12¼ — 13	12 1/16	12½
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	15 %	12½%	22½ — 23½	23 — 24	..	..
62,500£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	99 —102	99 —102	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	10%	36 — 39	36 — 39	38¾	..
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	..	..	..	98 —102	98 —102	..	..
1,988,888	National Telephone, Pref. Stock	100	5 %	5 %	6 %	101 —103	101 —103	102¾	101½
1,966,667	Do. do. Def. Stock	100	..	..	4½ %	74 — 76	79 — 81	80¼	75½
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 14	13 — 14	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	13 — 14	13 — 14	..	..
2,250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5 — 5¼	5⅛ — 5⅜	5¼	5⅛
000,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½ %	3½ %	3½ %	94 — 96	95 — 97	96	94¾
600,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	102 —104	102 —104	..	..
179,318	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6 %	6 %	13/16 — 15/16	13/16 — 15/16	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	..	..	..	1 — 1⅛	.. — ..	..	..
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 —100	97 —100	..	..
11,889	Reuter's	8	5 %	5 %	..	6¾ — 7⅛	6¾ — 7⅛	..	..
8,808	Submarine Cables Trust	Cert.	..	..	..	115 —120	116 —121	..	..
56,000	United River Plate Telephone	5	7 %	7 %	7 %	5½ — 6	5⅜ — 6	..	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4⅜ — 5¼	4⅜ — 5¼	..	..
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	104 —107	104 —107	..	..
15,600	West African Telegraph, Shares	10	..	..	2 %	5 — 6	5 — 6	..	..
150,000£	West Coast of America, 4% Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	..	..	..	95 — 98	95 — 98	..	..
267,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	11⅜ — 12⅛	11⅜ — 12⅛	11¾	..
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	100 —103	100 —103	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	98 —101	98 —101	..	..
88,821	West India and Panama Telegraph	10	¼%	..	..	7/16 — 9/16	7/16 — 9/16	..	..
84,563	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	5⅜ — 7	6¼ — 7	7	..
4,659	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	4 — 5	4 — 5	..	..
60,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	..	..	..	101 —104	101 —104	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

30,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	4½ — 5⅛	4½ — 5⅛	..	..
900,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	..	..	..	85 — 89	86 — 90	..	..
100,000	British Electric Traction	10	9 %	9 %	8 %	11½ — 12	11¾ — 12	11¾	11¾
100,000	Do. do. 6 % Cum. Pref.	10	..	..	..	11 — 11½	11 — 11¾	11 1/16	11⅛
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	120 —123	120 —123	..	..
100,000	British Insulated and Helsby Cables	5	15 %	10 %	10 %	6 — 6½	6 — 6½	6⅝	..
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5½ — 5⅝	5½ — 5⅝	..	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	102 —105	103 —108	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	8 %	Nil	..	1/16 — 1⅛	1/16 — 1⅛	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	6 %	..	14/6 to 15/6	14/6 to 15/6	..	..
105,781	Brush Electrical Engineering, Ord., 1 to 105,781	2	5 %	Nil	Nil	3/4 — 1	3/4 — 1	1	..
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	3 %	6 %	1¼ — 1½	1¼ — 1½	1¼	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	97 —100	97 —100	98½	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	85 — 90	85 — 90	..	..
85,000	Callender's Cable Construction shares	5	15 %	20 %	15 %	11 — 12	11 — 12	..	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5¼ — 5⅜	5¼ — 5⅜	5⅜	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	106 —110	106 —110	108½	108
1,860,014	Central London Railway, Ord. Stock	Stock	..	4 %	4 %	93 — 96	91 — 94	94½	91
494,098	Do. do. 4 % Pref. Stock	Stock	..	4 %	4 %	99 —102	99 —102	..	..
494,998	Do. do. Def. do.	Stock	..	4 %	4 %	99 —102	96 — 99	..	..
1,330,000	City and South London Railway	Stock	1½%	2 %	2½%	50 — 52	50 — 52	50	..
85,000	Crompton & Co., Nos. 1 to 85,000	8	8 %	7½%	5 %	1½ — 2½	1⅝ — 2½	1 5/16	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	100 —104	100 —104	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £8 paid, 1 to 99,261	5	2½%	Nil	..	0 — ¼	0 — ¼	..	..
17,189	Do. do. "A" shares, 01—017,189	5	2½%	Nil	..	1 — 2	1 — 2	..	..
344,023£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	72 — 77	72 — 77	..	..
100,000£	Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	..	..	..	76 — 81	76 — 81	..	..
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	6 %	1¼ — 1⅜	1¼ — 1⅜	..	..
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	..	..	..	2¼ — 3	2¼ — 3	..	..
82,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	97 —100	97 —100	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	9¾ — 10¼	9¾ — 10¼	9 3/16	..
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	96 — 99	96 — 99	..	..
85,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	20 %	14 — 15	14 — 14½	14	..
85,000	Do. do. 4½ % Pref.	5	4½%	..	..	5 — 5⅛	5 — 5⅛	..	..
48,050	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	108 —112	108 —112	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	10 %	18 — 19	18 — 19	18 1/16	18⅜
800,000£	Do. do. do. 4 % 1st Mort. Deb.	100	..	..	..	100 —103	100 —103	..	..
87,500	†Liverpool Overhead Railway, Ord.	10	3½%	1½%	1½%	4¼ — 4¾	4¾ — 5	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10¼ — 10¾	10¼ — 10¾	..	..
87,350	Telegraph Construction and Maintenance	12	17½%	20 %	20 %	34 — 37	34 — 37	35⅛	34½
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	100 —103	101 —104	..	..
840,000£	Waterloo & City Railway, Ord. Stock	100	3 %	3 %	3½%	91 — 94	91 — 94	91½	..

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

Bank rate of discount 4 per cent. (September 3rd. 1903).

SHARE LIST OF ELECTRICAL COMPANIES (*continued*).—ELECTRICITY SUPPLY COMPANIES.

Present issue.	NAME,	Stock or Share.	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations Nov. 18th.	Closing Quotations Nov. 25th.	Business done week ended Nov. 25th, 1903. Highest	Lowest
100,000	Blackheath and Greenwich Dist. Electric Light, Ord.	‡ £1	..	..	..	⅜ — ½	⅜ — ½	..	..
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs.	100	..	..	..	116 —119	116 —119	..	..
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000	£5	6 %	8 %	8 %	10½— 10¾	10½— 10¾	..	..
20,000	Do. 7 % Cum. Pref.	£5	..	..	..	10 — 10½	10½ — 10¾	..	..
50,000	Charing Cross and Strand Electricity Supply	£5	9 %	10 %	10 %	9 — 9¼	10 — 10½	9½	..
70,000	Do. do. do. 4½% Cum. Pref.	£5	..	..	..	5⅛ — 5¼	5⅛ — 5¼	..	..
40,000	Do. do. "City Undertaking" 4½% Cum. Pref.	£5	..	..	..	4¼ — 5	4¼ — 5	4 13/16	4 13/16
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	104 —106	104 —106	..	..
44,486	*Chelsea Electricity Supply, Ord.	£5	5½%	4 %	4½%	5⅛— 6	5⅛— 6	5⅛	..
150,000£	Do. do. % Deb. Stock Red.	Stock	..	..	..	107 —110	108 —111	..	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595	£10	0 %	5 %	5 %	10 — 10½	10 — 10½	10⅜	10½
40,000	Do. 6 % Cum. Pref., 1 to 40,000	£10	6 %	..	..	13 — 14	13 — 14	13½	13⅝
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid	..	..	..	..	122 —127	122 —127	..	..
800,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	..	..	..	102 —105	102 —105	..	..
40,000	County of London & Brush Prov. Electric Lighting, Ord. 1—40,000	£10	4 %	4 %	4 %	7½— 8½	7⅝— 8½	8¼	..
20,000	Do. do. do. 6 % Pref., 40,001—60,000	£10	..	..	..	11½— 12½	11½— 12½	..	..
400,000£	Do. do. 4½% Deb. Stock	..	..	..	..	107 —110	108 —111	110	..
250,000	Do. do. 4½% 2nd Deb. Stock	Stock	..	..	..	99 —102	99 —102	100⅜	..
50,000	Edmundson's Electric Corporation, Ord. Shares	£5	7 %	7 %	7 %	6¾— 6¾	6¾— 6¾	6 7/16	6½
80,000	Do. do. 6 % Cum. Pref.	£10	..	..	..	6 — 6½	6 — 6½	6½	..
140,000	Do. do. 4½% 1st Mort. Deb. Stock	100	..	..	..	104 —107	104 —107	106⅛	..
21,000	Kensington and Knightsbridge Electric, Ord.	£5	12 %	10 %	10 %	10½— 11½	10½— 11½	..	..
90,000	Do. do. do. 4 % Debenture Stock	Stock	..	..	..	101 —104	101 —104	..	..
110,000	London Electric Supply Corporation, Limited, Ord.	£3	..	..	..	1¾— 2¼	1¾— 2¼	..	..
49,840	Do. do. do. 6 % Pref.	£5	..	..	..	4¾— 5⅛	5 — 5⅛	5 5/16	4 13/16
250,000£	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	98 —101	98 —101	99	..
100,000	Metropolitan Electric Supply, 1 to 100,000	£10	6 %	6½%	7½%	17 — 18	17½— 18½	17⅞	17½
71,106	Do. do. 4½% Cum. Pref. 1—71,106, £3 paid	£5	..	..	..	4¼— 4⅜	4¼— 4⅜	4¼	..
220,000£	Do. do. 4½% 1st Mort. Deb. Stock	..	..	..	..	110 —114	110 —114	111	..
250,000£	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	96 — 99	96 — 99	..	..
10,852	Notting Hill Electric Lighting	£10	7 %	6 %	6 %	12½— 13½	12½— 13½	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	£5	14½%	14½%	14½%	14 — 15	14 — 15	14 5/16	14½
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	£5	..	..	..	8 — 9	7½— 8½	8⅛	8
150,000£	Do. do. do. 3½% Deb. Stock Red	£100	..	..	..	97 —100	98 —101	..	..
12,000	Smithfield Markets Electric Supply, Ord.	£5	..	..	2½%	5 — 8½	8 — 8½	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	..	..	..	85 — 90	— —	..	..
65,000	South London Electricity Supply, Ord.	£5	..	..	1¾%	3½— 4	3½— 4	..	..
80,000	Urban Electric Supply, Ord.	£5	..	..	..	4½— 5⅛	4½— 5⅛	..	..
80,000	Do. do. 5 % Cum. Pref.	£5	..	..	..	4½— 5⅛	4½— 5⅛	..	..
110,000	Westminster Electric Supply, Ord.	£5	10½%	10½%	12 %	12 — 13	11½— 12½	12 5/16	12
28,141	Do. do. 5 % Cum. Pref.	£5	..	..	..	6 — 6½	6 — 6½	..	..

* Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS, Wednesday, November 25th.

	CHEMICALS, &c.		Latest Price.	Week's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	,, Nitric	per cwt.	22/-	..
a	,, Oxalic	per cwt.	32/-	..
a	,, Sulphuric	per cwt.	5/6	..
a	Ammoniac, Sal	per cwt.	42/-	..
a	Ammonia, Muriate (crystal)	per ton	£33 10	..
a	,, ,,	per ton	£30	..
a	Bleaching powder	per ton	£4 10	..
a	Bisulphide of Carbon	per ton	£15	..
a	Borax	per ton	£13	..
a	Benzole (90 %)	per gal.	7/-	..
a	,, (50/90 %)	per gal.	5/6	..
a	Copper Sulphate	per ton	£20	..
a	Lead, Nitrate	per ton	£24	..
a	,, White Sugar	per ton	£31	..
a	,, Peroxide	per ton	£27 10	..
a	Methylated Spirit	per gal.	2/6	..
a	Naphtha, Solvent (90% a 160° C).	per gal.	5/6	..
a	Potash, Bichromate, in casks	per lb.	8d.	..
a	,, Caustic (75/80%)	per ton	£24	..
a	,, Bisulphate	per ton	£35	..
a	Shellac	per cwt.	231/-	8/- inc.
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers	per ton	£6 10	..
a	,, Recovered	per ton	£5 10	..
a	,, Lump	per ton	£5	..
a	Soda, Caustic (white 70 %)	per ton	£10 15	..
a	,, Crystals	per ton	£8	..
a	,, Bichromate, casks	per lb.	2½d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots	per ton	£130	..
b	,, Wire, in ton lots	per ton	£168	..
b	,, Sheet, in ton lots	per ton	£166	..
p	Babbitt's metal ingots	per ton	£48 to £130	..
c	Brass (rolled metal 3" to 13") basis	per lb.	6¾d.	..
c	,, Tube (brazed)	per lb.	8¾d.	..
c	,, ,, (solid drawn)	per lb.	7¾d.	..
c	,, Wire, basis	per lb.	7d.	..
c	Copper Tubes (brazed)	per lb.	9¼d.	..
c	,, ,, (solid drawn)	per lb.	9¼d.	..
g	Copper Bars (best selected	per ton	£71	..

	METALS, &c. (*continued*).		Latest Price.	Week's Inc. or Dec.
g	Copper Sheet	per ton	£71	..
g	,, Rod	per ton	£71	..
e	,, (Electrolytic) Bars	per ton	£68	£2 dec.
e	,, ,, Sheets	per ton	£78	£2 dec.
e	,, ,, Rod	per ton	£75	..
e	,, ,, H.C. Wire	per lb.	7¾d.	¼d. dec.
f	Ebonite Rod	per lb.	3/3	..
f	,, Sheet	per lb.	8/-	..
m	German Silver Wire	per lb.	1/6	..
h	Gutta-percha fine	per lb.	8/-	..
h	India-rubber, Para fine	per lb.	3/11 to 4/-	1d. inc.
i	Iron, Charcoal Sheets	per ton	£18	..
i	,, Pig (Cleveland warrants)	per ton	42/8	2d. dec.
i	,, Forgings, according to size	per ton	From £11	..
i	,, Scrap, heavy	per ton	47/6 to 50/-	..
i	,, Wire, galvanised No. 8	per ton	£9 15	..
g	Lead, English Ingot	per ton	£11 7 6 to £11 10	..
g	,, ,, Sheet	per ton	£13	..
m	Manganin Wire No. 28	per lb.	8/-	..
g	Mercury	per bot.	£8 7 6	..
d	Mica (in original cases) small	per lb.	4d. to 1/6	..
d	,, ,, medium	per lb.	2/6 to 3/9	..
d	,, ,, large	per lb.	4/- to 7/9	..
p	Phosphor Bronze, plain castings	per lb.	1/- to 1/3½	..
p	,, rolled bars & rods	per lb.	1/- to 1/3	..
p	,, ,, strip & sheet	per lb.	From 1/1	..
o	Platinum	per oz.	£4	..
p	Silicium Bronze Wire	per lb.	9d. to 11d.	..
i	Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i	,, in bars		£15 to £40	..
g	Tin, Block	per ton	£120 10 to £121 10	10/- inc.
g	,, Foil	per lb.	1/6	..
n	,, Wire, Nos. 1 to 16	per lb.	1/7	..
p	White Anti-friction Metals— "White Ant" brand	per ton	£42 to £62	..
j	Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j	,, 6 ies. Flax	per lb.	5½d.	..
j	,, 8 ply 10 lbs. Russian	per lb.	4½d.	..
j	,, 10 lbs. Russian, single	per lb.	4¾d.	..
j	,, 160 lbs. Jute rove	per ton	£11	..
k	Zinc, Sh't (Vieille Montagne bnd.)	per ton	£23 15	..

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons., Ltd.; *d* F. Wiggins & Sons.; *e* Frederick Smith & Co.; *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakespeare; *h* Edward Till & Co.; *i* Bolling & Lowe; *j* Walter H. Hindley and Co., Ltd.; *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons; *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RECEIPTS.

	Locality.	Week ending	Receipts for the week. £	£*	Total to date. £	£*	Miles open.	*
	Aberdeen	Nov. 21	1,040	+288	31,673	+ 5,268	10	—
	Birmingham	,, 21	4,877	+242	239,323	+ 9,479	—	—
	Bournemouth	,, 18	779	—	—	—	10½	—
	Blackburn	,, 20	731	+ 13	29,575	+ 963	12½	+1½
	Blackpool	,, 19	500	+ 15	36,235	— 208	8½	—
	Blackpool and Fleetwood	,, 21	146	+ 1	19,873	— 110	7½	—
	Blackpool and Lytham	,, 19	167	+ 87	459	+ 209	—	—
	Bolton	,, 22	1,697	+175	68,294	+ 7,700	25	—
	Bradford	—	—	—	—	—	41	+4
	Brighton	,, 22	751	+102	45,987	—	6½	—
	Bristol	,, 20	4,903	+266	—	—	28	—
	Burnley	,, 21	751	+ 95	—	—	7½	—
Br. E. T. Co.	Barnsley District	,, 18	169	— 27	8,217	— 27	4½	—
	Devonport	,, 18	5.7	+123	21,009	+ 1,223	5	—
	Dudley—Stourbridge	,, 18	782	+ 33	38,171	+ 8,628	18½	—
	Gateshead	,, 18	897	+ 49	39,899	+ 5.29	10½	+ ½
	Gravesend—Northfleet	,, 18	223	+ 36	11,070	+ 1,124	8½	—
	Greenock—Pt. Glasgow	,, 18	550	+ 64	25,042	+ 2,035	7½	—
	Harlepool	,, 18	948	+ 26	12,388	+ 758	6½	+2
	Kidderminster	,, 18	97	— 5	5,884	+ 165	4½	—
	Merthyr	,, 18	202	+ 27	9,077	— 90	8	—
	Middleton	,, 18	255	+ 44	14,614	+ 1,811	8½	—
	Oldham—Ashton	,, 18	532	+ 15	25,995	+ 1,579	8	—
	Peterborough	,, 18	150	—	6,776	—	—	—
	Poole	,, 18	252	+ 28	13,974	+ 2,025	8½	—
	Potteries	,, 18	1,658	— 94	73,016	+ 8,618	28½	—
	Rothesay	,, 18	89	— 1	6,774	+ 1,606	2½	—
	Sheerness	,, 11	58	—	2,759	—	2½	—
	Southport	,, 18	259	+ 9	14,483	+ 2.547	8½	—

* Compared with the corresponding period of 1902.

	Locality.	Week ending	Receipts for the week. £	£*	Total to date. £	£*	Miles open.	*
	South Staffordshire	Nov. 18	991	+814	41,548	+ 6,882	21½	−½
	Swansea	,, 15	507	+ 58	23,721	+ 1,992	8½	—
	Taunton	,, 18	44	— 7	2,792	— 197	1½	+1½
	Tynemouth	,, 18	214	— 9	14,465	+ 786	9½	—
	Weston-super-Mare	,, 11	89	— 8	5,580	— 518	2½	+2½
B.E.T. Co.	Wolverhampton Dist.	,, 18	371	+ 42	17,228	+ 7,556	10½	+8
	Wrexham	,, 18	116	—	4,580	—	6	—
	Yorks. Woollen Dist.	,, 18	388	—	14,710	—	6	—
	Cardiff	,, 14	1,865	+332	65,996	+18,480	14	—
	Chatham & District Co.	,, 12	509	+158	24,521	+13,333	8·53	—
	Dover	,, 14	165	— 7	10,236	+ 51	3	—
	Dublin	,, 20	4,184	+ 82	108,887	+ 7,765	46½	+ ½
	East Ham	,, 21	588	+190	23,274	+ 6,885	5	+ ½
	Glasgow	,, 21	13,398	+1205	843,159	+86,398	66	+ 4
	Hull	,, 21	1,834	+220	63,842	+ 3.583	11½	+1½
	Ilkeston	,, 18	124	—	5,140	—	4	—
	Isle of Thanet	,, 21	268	+ 29	82,044	— 1,620	10½	—
	Leeds	,, 21	4,992	+332	195,020	+11,729	41	—
	Liverpool	,, 14	10,163	+455	464,410	+14,981	108	—
	Manchester	,, 21	10,798	+5915	400,415	+241,210	72	—
	Newcastle	,, 21	3,448	+567	—	—	17	—
	Portsmouth	,, 21	1,319	+271	63,495	—	14½	—
	Salford	,, 16	3,813	+940	126,944	+38,109	30	—
	Southampton	,, 19	854	+ 12	—	—	9	—
	Sunderland	,, 22	1,055	+ 83	42,776	+ 2,088	20	+8
	Central London Railway	,, 21	7,188	— 95	133,059	+ 6,719	6	—
	City and S. London Ry.	,, 28	3,060	— 461	54,691	— 8,658	6½	—
	Dublin and Lucan Rlwy.	,, 22	87	+ 6	2,766	+ 171	6½	—
	Liverpool Overhead Ry.	,, 23	1,592	+104	35,186	+ 2,813	6	—

NOTES ON PAPERS AT THE SYRACUSE (U.S.A.) STREET RAILWAY CONVENTION.

The Street Railway Association of the State of New York met this year at Syracuse, and the sayings and doings of the members are duly reported in the *Street Railway Journal* of October 10th and 17th. The papers covered the whole field of street railroading, and the task of presenting them in a "Bovrilised" form for the busy readers of the Review is not too light.

A distinct departure was made by the presentation of two papers relating to accidents and claims, one by a doctor, and another by (presumably) the claim agent of a large undertaking. The predominating note of each is the prevention and detection of the bogus claimant in all his stages. The type is by no means unknown in Britain, but it seems to be indigenous to, and to flourish best in, the United States.

All kinds of interesting stories of the tricks of this lucrative business—sometimes a profession—are told, and both authors make it very evident that medical examination on behalf of the company must never be neglected, although one points out that it is not well, either from the professional standpoint of the doctor, or for the interests of the company, that the company's doctor should always be in immediate attendance on an accident.

An accident claim worked by a clever or a hysterical subject requires to be opposed delicately enough; but when it is supported by the opinion of a private practitioner, and pushed by a sharp lawyer, the chances of a moderate settlement, or of a verdict by a jury in favour of the company, are greatly lessened.

We are happy in the belief that the unscrupulous or ignorant doctor has not to be taken into account by the British claim agent or manager, although he is not unknown in the enormous country of our cousins; but there is no doubt that we do suffer in a comparatively mild degree from the sharp lawyer (let us speak euphemistically) who takes up claims for what they are worth, and is known even to hunt for them. This gentleman is fully developed in the States, and is there known variously as the fake lawyer and the ambulance chaser.

The American Street Railway Association adopted the tee-rail as standard, but the speakers at Syracuse were not inclined to favour its use except in suburban districts or in small towns, because when laid in busy thoroughfares the marginal paving, of whatever material made, is quickly destroyed, and the road maintenance charges soon out-balance the undenied advantages of the tee-rail from the tractive effort point of view.

Militating more strongly against the decision of the A.S.R.A. is the ban of the tee-rail by most of the municipal authorities in the Eastern States. Not unnaturally these authorities object to the presence of ruts from 2 to 6 in. deep alongside the rails.

Rather tending to show that American paving is neither so good in itself nor in its laying as ours, is the curious fact that large cities are beginning to use a girder rail with a lip especially thickened to act as a "plate-way" for vehicular traffic, thus saving the paving. In Philadelphia a rail weighing 137 lbs. per yard is being laid, in which the extra weight is mostly in the lip.

Only in populous towns where the streets are narrow, and the wheeled traffic cannot be pushed off the tracks, need such a section be used. The American street railway can be trusted to keep the tracks clear wherever the streets are wide enough.

Grooved girder rails are laid already in New York, Chicago, Washington and Philadelphia.

The use of a 9-in. section must strike an English engineer as strange, but it seems to be quite common in the States. Maybe, when the Americans get used to the solider construction of permanent way which they are only beginning to appreciate, they will find themselves able to reduce the height of their rails.

There is no doubt that, in the matter of track, a levelling up to our standard is taking place. Of course, there have been many miles of sound concrete-founded track laid for years on the best of the street railways, but a very high percentage is not so founded.

When reviewing American practice in previous issues, we have mentioned that, even when either a solid concrete bed extending from rail to rail and beyond, or a concrete stringer or beam under each rail is laid, the use of sleepers (American "ties") is not abandoned, and we have suggested that construction on similar lines might be acceptable to the public as providing softer and less noisy riding, and to the undertakers as lessening the cost of maintaining rolling stock and ways. A well-seasoned and thoroughly pickled sleeper buried in concrete should last as long as the superimposed rails If not, it would be worse than useless, as its renewal would involve ripping up the track before its time.

With the increased permanence of the track, the Americans are bringing more into use the steel sleeper spaced about 10 ft. apart. With these there is no doubt about the life being as long as the rails, and no fear that the roadbed will have to be disturbed prematurely.

It appears that in Buffalo the average wear of the table of the rails in the busiest street taken over four years was $\frac{1}{32}$ in. per annum. If, therefore, the life of a rail depends simply on the wear at its mid-length, the life of these Buffalo rails will be 16 years if the car-wheels have $\frac{3}{4}$ in. deep flanges. And Buffalo hopes that the life of the rails does depend on the above factor alone, for the joints have been wiped out by welding.

Cast-welding has been in use, in the Western States at least, for eight years, and the percentage of broken joints appears to have been never less than 2½, while the record for electric welding during last year was no more than one-tenth of 1 per cent. It is well known, however, that the blessing of a continuous rail cannot be obtained at a small cost (although it is probable that the dearest method is cheaper in the end than a discontinuous rail, so commonly used), and it is here stated that electric welding, with its four cars full of power stations and workshops, is too expensive for any number under 2,000 joints.

We are surprised that no figures are given relating to the Goldschmidt weld.

The following words should be taken to heart by all directors, committeemen and engineers who are laying even now rails fished with the railway fish-plates, with perhaps an inadequate sole plate under the joints:—"If a road is so small that it cannot afford to put in electric or cast-welded joints, it should use the best type of mechanical joint. . . ."

There is no reason to think that the wear of the Buffalo rails is excessively small, or that a jointless rail will not last from 15 to 20 or more years according to the traffic over it, always granting that the concrete has been well and truly laid, while there is too much reason to think that the greater part of the rails laid in England will at least deserve removal in half the time. Companies with 21 years' leases will find that weak mechanical joints on heavily-used rails will make it necessary either to renew the rails three times instead of twice during the lease, or to spend outrageous sums in maintenance or in the worst case to allow the whole track to get into the same condition as the old steam tracks were in towards the end of the leases on them.

A local authority with perpetual tenure, and with less need to study the capital account, should undoubtedly strive after the continuous rail, and reduce to the lowest the compulsory depreciation that is coming sooner or later. It must not be forgotten that the jointless rail affects favourably not only its own life, but the life and the maintenance of the paving, to say nothing of the rolling-stock, for movement of the rails would be negligible, and sett-loosening water-hammer would disappear in consequence.

While the American steam railroads have made the 33-ft. rail standard, the street railways represented at the Syracuse Convention are unanimously in favour of the 60-ft. rail, even, curiously enough, for unpaved work where the whole rail is exposed to greatly varying temperatures. Some small trouble from buckling has arisen, but it is considered that the decreased joints and bonds more than cover that.

The cost of maintaining the tracks of nine large companies during 1901 varied all the way from £43 per mile up to £147 per mile, and the costs do not seem to bear any close relation to the number of miles maintained. It is not possible, however, to base any just comparison on the figures, as the conditions are dissimilar.

Quite a long time was given up to the promotion of the cause of the Railway Y.M.C.A. This organisation boasts a membership of 62,000, and is seeking to extend its influence for good into the street railway field. Progressive managers have been brought into sympathy with its work, partly because they see that it is good business to educate their employés to care for themselves by putting within their reach comfortable club rooms, varied amusements, health-giving recreations, opportunities for greater personal cleanliness, more intimate social intercourse, and the myriad things that make for a higher state of civilisation and of bodily and mental efficiency, but are lamentably absent from the homes of the men themselves. The success of the Association among the steam road employés, and the fact that the companies subscribe equal or greater amounts than the men is sufficient proof that its practical value is recognised.

The secretary, speaking at the Convention, said with reference to the religious element of the organisation, "We don't hide it, we don't apologise for it, and we don't intrude it. . . . The Association stands for twentieth century religion. It believes that affording a man a chance to have a clean bed and a square meal is a religious act."

There is an opening for an organisation of this kind on many of the tramways in Great Britain. There have been some disheartening failures of clubs based on the same general idea, but we doubt whether the reasons usually given for these failures are sufficient to remove an uneasy feeling that there was something radically wrong, or constitutionally weak in the organisation itself. Men employed on tramway staffs are certainly no worse than soldiers, both being drawn from the same class, and it has not been voted impossible in the army to raise the general level of the men by such means as are employed by the Y.M.C.A. all over the world.

The organisation and successful management of an employés' institution or club calls for very delicate touch, and intimate or instinctive knowledge of the class for which the work is being done, and it is probably there that unsuccessful organisations have failed, and there that an expert body like the Y.M.C.A. would succeed. If that be so, it points to future efforts being made with the aid of such a body.

The author of a paper on "Power Transmission for Interurban Lines" considers that, until electrical engineers can prove greater economies than now exist, it will be impossible to persuade main line railways to scrap steam engines which have been brought up to the limits of economy themselves.

He shows that we cannot expect any improvement in the efficiencies of the present types of engines, generators, motors or transformers, and that the line losses cannot be reduced to pay by further raising pressures or increasing sections of copper.

"It becomes evident that the desired increase in efficiency must come, not in the present system, but in some other one that will possess all the advantages now obtained, and will reduce waste energy to a minimum by doing away with all unnecessary steps or tranformations in the power generated."

And we seem to be really near something of the kind.

The author prefers the rotary converter to the motor-generator either of the induction or synchronous type.

The discussion ran on the danger of extra high-tension transmission, and it seems that ideas on the subject are not at all fixed. Two cases were mentioned in which transmission lines are being held up while the New York State Board of Railroad Commissioners decides whether a wire at a pressure of 16,000 volts carried over a man's sidewalk is a menace to his life! Of course it seems so to us, but there are too many instances of even higher pressures being carried over populated districts without causing a general holocaust, to keep back progress in New York State for very long.

One gentleman, while sounding a note of warning as to the possibility of preventive or restrictive legislation following the actual use in several cases by the General Electric Co., and the Westinghouse Co., of 60,000-volt transmission, made the prophetic statement that the time is coming when not a 100 H.P. worth of water will be falling over Niagara. And when you come to think of it, why should it, if it can be made to drive cars and things hundreds of miles away? Niagara will be none the less wonderful when it has vanished.

One other point of interest to English readers was raised at the Convention, and that dealt with the comparative merits of chilled-iron and steel-tired wheels for high speeds. We think that the most inveterate chilled-wheeler will admit that there is a far greater possibility of a flange breaking, or rim bursting on a chilled-iron wheel than there is with a steel wheel when running at speeds as high as 50 to 62 miles per hour. If there is this greater risk then the iron wheel should not be used, however great are the advantages of price and other things, for an accident of that description would in all likelihood result in personal injury or death to passengers.

On the Utica and Mohawk Valley line the wheel flanges are 1½ in. deep by 1¼ in. thick, and the treads are 2⅝ in. wide. The trouble with the deep flanges seems to be the same as we shall begin to experience over here; the cars have to run over rails with a limited groove inside towns as well as over the high-speed inter-urban tracks where grooves do not trouble. The consequence is that on the urban sections the car is riding on the bottom of the flanges only.

INSTITUTION OF ELECTRICAL ENGINEERS.

Inaugural Address by Robert Kaye Gray, President.

(*Delivered on Thursday, November 12th, 1903.*)

(*Concluded from page* 844.)

I am afraid I am wearying you by reiteration, but I feel strongly on this subject, which, in my opinion, affects the vital interests of the Institution, and I venture to lay before you things that though perhaps to many of you are platitudes, may prove of use to our younger colleagues. The establishing of electrical tramways, and the electrification of existing railway and tramway lines, are rapidly assuming great proportions, and it is not difficult to predict that this branch of electrical engineering will continue to advance by leaps and bounds, providing employment for many electrical engineers connected with the Institution. From the report of the London County Council on the excellent work they have been doing in South London, it would appear that the difference in prime cost between laying an urban line on the conduit system and construction on an overhead trolley system is not so great as to render the former altogether impracticable. I think, therefore, those authorities in the municipal areas are acting in the best interests of the inhabitants of this crowded metropolis, who refuse to authorise erection of the unsightly, and in many cases dangerous, overhead conductors. The utilitarian may argue that whatever increases prime cost goes in restriction of development, and in this he is to a certain extent correct. But apart from the question of danger avoided, it is usual in civilised communities to have some respect for forms and appearances as well as for the purely useful. Moderation should reign in all things, and in relation to electrical tramways London does better to employ the conduit system and follow the example of Buda-Pesth and Paris, rather than erect an overhead system similar to that which disfigures my native city of Glasgow, and many other towns in this country. The conduit system has cost London per mile of single line about £14,000; an overhead installation would have cost £7,000. In my opinion, the difference is well spent. It may be argued that this difference does not represent the whole difference, and that many electrical arrangements can be made in an overhead system that would not be permitted in a conduit system. My answer to this is that it comes within the province of us engineers to overcome these difficulties; overcome them we shall if we only apply ourselves seriously to the task, and produce results which will pass the severest test that the Home Office, Board of Trade, or other authority may impose.

Passing on to the nature of the current supply, the continuous-current system predominates at present in Great Britain for all kinds of electric traction. Its supremacy is again being threatened by the monophase system, whose employment in certain cases possesses advantages that are greater than the disadvantages. The efficiency of polyphase working for traction purposes has not been sufficiently proved, but as regards the method of transmitting power to considerable distances for conversion to continuous current to be applied to tramway purposes, the three-phase system has so far held the field at pressures up to 6,500 volts. A most complete system of high pressure polyphase traction work was inspected by many members of the Institution during a visit to Northern Italy in the spring of this year, and to those interested in this subject, it will be useful to closely follow the fortunes of the electrified Valtellina, Lecco and Milan Railway. For this line there are in course of construction electric locomotives, which have been designed to exert a tractive force of from 7,500 to 11,000 lbs., at a speed of 40 miles per hour, their individual output being, I understand, from 800 to 1,200 H.P. The exceedingly interesting experiments being made on the Marienfelde-Zossen Military Railway have resulted so far in the attainment of a speed rated at 125 miles an hour. The railway from Berlin to Zossen is about 15 miles in length, and the current generating station is about 8 miles from the head of the line. The car, a Siemens & Halske design, was supplied with power from the line wire at a pressure of about 14,000 volts.* The inauguration of through traffic between Liverpool and Bolton, a distance of 40 miles, marks an important epoch in the progress of the South Lancashire Tramway project, which embraces a network of more than 500 miles of track, and will serve an area whose population is about 5,000,000.

The application of electric traction to our railways is progressing. At present the sections which are being dealt with are those which have a great traffic density or a frequent service. This policy is doubtless a wise one, as the railway companies limit the application of a considerable capital expenditure to the best paying division of their lines, and to those portions where the benefits to be derived are the most apparent. During the current year, the first section of the Metropolitan-District Railway conversion has been made, and it is expected, before March of next year, that the Moorgate Street—Drayton Park and Drayton Park—Finsbury Park sections of the Great Northern and City Railway Co. will be in operation. The Mersey Tunnel Railway has been completed, and the conversion of the Wirral Railway is under consideration. The North-Eastern Railway has had trial runs along Tyneside, and good progress is being made with the Liverpool—Southport line. The Central London Railway is completing the change from locomotive to motor-car driving. The motor-car system is generally accepted as the best form for passenger traffic for many reasons, which I need not recapitulate. The direct-current system at 500 to 700 volts appears to remain as a standard for railway work of this class, as well as for tramway work, but there are signs that single-phase alternating current may prove a rival. In the United States the Washington Annapolis Railway is being equipped with an overhead system, which will deliver direct to the motors a single-phase current at 3,000 volts. The three-wire system of feeding tramways and railways, though not without examples abroad, has not been adopted in this country, save on the City and South London Railway, where it seems to have proved satisfactory.

The only surface contact system in this country is that which has had nearly a year's trial at Wolverhampton. Troubles have arisen between the Corporation and the company; it is, therefore, impossible to say exactly how the matter stands. It is believed that the Kingsland mechanical switch surface contact system may be tried at Dresden shortly.

Although accumulators are being extensively used for private carriages in London and elsewhere, yet this country has not seen its way to employ them for rail or tramways. In Italy and Germany some use is made of them, and it is stated that as the result of two years' working on lines running out of Bologna, the cost of battery traction has proven 28 per cent. cheaper than steam. The use of storage battery locomotives in America for shunting and mine work appears worthy of mention, as it seems to have attained considerable proportions, and to have proved successful in practice.

In the provinces the great power distribution undertakings are getting to work by degrees. Besides the Midland and Newcastle concerns we can now count the Durham, Lancashire, North Metropolitan and South Wales companies. The advantages of electricity as a motive power seem to be readily appreciated by the industrial populations of these districts. Among some of the large schemes in project is the electrification of the National Railways of Sweden, the original power being derived from water power or the combustion of peat. Estimates are being drawn for 2,700 miles of railway, calling for over 100,000 H.P. The official estimate shows that there will result a saving of 50 per cent. in the present working expenses which amount to about £800,000 per annum. Switzerland again speaks of a conversion of its national lines, entailing the use of 30,000 H.P. to be obtained from water power.

The utilisation of the Victoria Falls of the Zambesi is a project under serious consideration, and at least a portion of the scheme may be near realisation. Some three months ago certain details of the scheme were made public, and from these it appears that whereas the Niagara Falls are equivalent to a continuous loss of 7,000,000 H.P., at the Victoria Falls of the Zambesi the loss is five times as great. In advocating the utilisation of this waste it is pointed out that tramways near San Francisco are driven by a current which has its origin in the Ubax Falls about 220 miles away, and that some American engineers estimated that power giving a steady load of 24 hours per day could be delivered 330 miles from the generating plant at about £4 10s per KW. At Niagara, six syndicates are carrying out work which, when completed, will be capable of generating over 1 million H.P. Some of the generating sets will be of 10,000 H.P. working at 11,000 volts. The pressure will be converted to 60,000 volts. The highest pressure as yet made use of in Europe for power transmission is in Italy, namely, 40,000 volts. This plant is not yet completed; it is intended that water power will develop 7,500 KW. at 9,000 volts (42 cycles per second), which will be transformed to 40,000 volts for transmission. In the United States, in Montana, where a similar pressure is

* Since writing the foregoing I notice that the car designed by the Allgemeine Elektricitäts Gesellschaft has, on the same line, attained a speed of 130½ miles per hour.

employed for transmission, the voltage was increased to 80,000 for a few hours with success. Consideration of these voltages recalls the experiments made in March, 1883, just 20 years ago, by Marcel Desprez in power transmission between Paris and Creil, a distance of 57 kilometres, at a pressure of 5,700 volts. One also thinks of the transformer of Gaulard of about that period.

I now turn to the subject which gave birth to this Institution, and from which its first title was derived—I mean the subject of telegraphy. Between May 26th and July 7th of this year an International Conference of the Telegraph Administrations was held in London at the invitation of His Majesty's Government. These meetings are, so far as may be, quinquennial, and are usually held in the capitals of the Great Powers. The last meeting in London took place in 1879. The discussions which are now carried on between the Government delegates, and with the representatives of the telegraph companies who are also invited to be present, are purely of an administrative order, and principally deal with tariffs and the rules for carrying out the international exchange of telegrams. Technical questions such as the size of conductors and the classes of instruments to be employed in the international service are either already agreed upon or are the subject of separate and private understandings between the administrations interested. These have been fairly well standardised during the 38 years that have elapsed since the first Conference was held in Paris.

Since 1879 the growth in the length of telegraph landlines has been very large, and the development of submarine telegraphy has been almost phenomenal. At that date the public were just beginning to realise what power for good or for evil was being placed at their disposal. Merchants were beginning to feel that the submarine telegraph had a centralising effect which enabled them to carry on their business with smaller stocks of goods. The large merchant had no longer the control of the foreign markets which his wealth had formerly given him, and the small merchants began to have an innings. When this state of things came home to the traders, submarine telegraphic facilities were in great demand; the cables across the Atlantic and other oceans began to multiply, and new centres of industry were connected to the chain. The men at the head of cable affairs, and notably the late Sir John Pender, were not slow to meet these developments by increasing the ramifications of the telegraph network, and bringing the charges for telegrams to such a figure as to encourage the public to make full use of the means of inter-communication placed at their disposal. This policy was hastened by the wholesome dread of competition, where such did not exist, and by competition itself. A year ago the gap in the world's telegraphic girdle was completed by the laying of the the trans-Pacific cable which now unites Canada with Australia, and this year has seen completed a second line across the Pacific from San Francisco to the Philippines and China by way of the Sandwich Islands, Midway and Guam.

It is strange that during this development, the improvements in the types of telegraph cable employed have not been great, nor has there been any great advance made in the design of the instruments used for the transmission of signals, but the administrative work has been vastly bettered. Messages which formerly took hours in transmission are now received from the public and delivered to the addressees in a few minutes. I am informed that a telegram announcing the result of the yacht race for the America Cup was carried, in August last, from London to South Australia in four minutes. This message, which was forwarded *vid* South Africa, was handled by 15 operators, passed through 11 stations, and traversed 14,404 nautical miles of submarine cable and 1,515 statute miles of land lines. Ordinary commercial traffic cannot be dealt with at this speed, but the instance I quote shows what can be accomplished when special arrangements are made to carry news which is of peculiar interest. The manager of an American Cable Co. has told me that the result of the America Cup Race reached London one minute after the termination of the race, having been transmitted through 3,400 nautical miles of submarine cable, and some 200 statute miles of land wire. The record time between New York and London is 30 seconds, and messages have been sent and replies received in one minute and 30 seconds.

During the last 25 years, the engineers engaged in submarine telegraph work have devoted more care to the surveys of route than was previously the practice; to a great extent this means that the engineers have succeeded in persuading the capitalists that these surveys are of prime importance. The Atlantic cables of 1857-8, of 1865, 1866, and on to 1874 were laid on the data as to the ocean bed furnished by perhaps 30 soundings taken over a route some 1,700 nautical miles long. In 1871, Lord Kelvin furnished a means for sounding which did not exist previously, and in 1872 the Silvertown Co. made a first trial. The late Sir William Siemens, in 1874, carried out the first systematic sounding in the Atlantic, and from that time forward until 1883 it was the habit to take soundings, but not to make a full and careful survey. With the results obtained from these soundings our knowledge of the ocean bed was increased to the extent of teaching us that submarine mountains, plains and gullies exist, and that the physical conditions of the submarine floor are very similar to what one observes in travelling through Europe from Calais to Brindisi. In 1883, the first thorough preliminary survey of any cable route was made, but as this has been the subject of a paper read before the Institution on November 10th, 1887, I need not enter into detail, further than to say that the result of this survey materially altered the original plans for laying the cable on account of unsuspected elevations and depressions of the ocean floor having been discovered. In addition to the configuration difficulties to be encountered by a submarine cable, the chemical composition of the soil is important, as it greatly affects the cable's life. A paper referring to this subject was read before the Institution on March 11th, 1897. I had the pleasure of handling, about a month ago, a piece of submarine cable which had lain at the bottom of the sea in deep water for nearly 30 years, and its appearance was such that I was unable to say whether it could not have lain there for another 30 years without showing any deterioration. To-day there are employed in cable work 47 ships representing 92,094 tons. The largest, the *Colonia*, belongs to the Telegraph Construction and Maintenance Co., and has a deadweight capacity of 11,000 tons. When he considers the comparative facility with which cables are now repaired, no shareholder in a submarine telegraph company need fear for the permanency of his property. In July, 1879, there were 50,450 nautical miles of cable in operation; there are now under the sea 222,253 nautical miles, and I have every reason to believe that this mileage will continue to increase.

On wireless telegraphy I have no new developments to report. The Cantor Lectures delivered by our vice-president, Prof. J. A. Fleming, before the Society of Arts, in March of this year, and the description of the Lodge-Muirhead system in *Page's Magazine* for last May, give to any one interested in the subject the latest communicated information of any value. I need only add that there seems no immediate prospect of its seriously competing with the business of the existing telegraph companies.

In my remarks concerning the means of transmission through submarine cables, I omitted to make reference to the relay of Mr. S. G. Brown which was described by him in the paper he read before the Institution on May 1st last year. I may also mention that since 1879 considerable improvements, though of a minor nature, have been made in duplex transmission.

The use of the telephone continues to extend, and in addition to the greater facilities offered in Great Britain, there are gradually being established international wires which place in telephonic communication the principal towns of Great Britain and several of the commercial centres on the Continent.

So far as I am aware no practical use has yet been made of Poulsen's teleautograph, which I had the pleasure of inspecting with our vice-president, Mr. Gavey, and of which he gave a description in a communication to the Institution on November 22nd, 1900.

Before passing to the next portion of my subject, I should like to make a short reference to a very early investigator into the phenomena of magnetism: I mean Dr. William Gilbert.

Our past-president, Dr. Silvanus Thompson, who has taken so great an interest in the bibliography connected with Gilbert, tells me that the tercentenary of the death of this remarkable man will occur on December 10th next (new style), and that probably some notice of the fact will be taken by his native town, Colchester, and by the Royal College of Physicians, of which body Gilbert was president at the time of his death. As you are doubtless aware, the work by Gilbert, notably his "De Magnete Magneticisque et Magnomagnete Tellure," shows a patient observation and careful recording of results, which resemble in many ways the method of Michael Faraday.

Your Council have not yet decided what steps, if any, will be taken by the Institution in connection with this celebration.

Whilst reviewing the state of electrical progress, mention should be made of the work of the Engineering Standards Committee.

This Committee is making some progress in its work, and it is pleasing to note that the Government has recognised that the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, the Iron and Steel Institute, and this Institution, should be assisted in the useful work they are doing. A Government grant has been made which will lighten the burden of these institutions, as until this assistance was received they were not only doing the work, but were also providing the funds necessary for carrying it out. Sir William Preece and Colonel Crompton, two of our past-presidents, are members of the General Committee and represent the Institution. The former is chairman of the Electrical Plant Divisional Committee, which is most directly connected with our branch of the subject. It is to be hoped that some of the results of the deliberations of the Electrical Plant Committee may shortly be published, and should they be, I shall append them to this address by way of further publication.

While speaking of the work of the Engineering Standards Committee, I cannot resist the temptation to protest against the continual attempts which are made to apply to our weights and measures and money, what is called the decimal system. However regrettable it is that scientific men should not have boldly recommended for adoption 12 instead of 10 as the place ratio of figures when so many sweeping changes were made at the time of the French Revolution, I am afraid they are too indolent to do so now, and that 10 will continue in use until another universal upheaval changes all things. Because 10 is conventionally adopted for this ratio, there appears to me no reason why the system should be extended to all the weights and measures necessary for common use, bringing about many absurdities, and in many cases establishing very inconvenient standards. The adoption of the metre or any other measure of about its dimensions as a unit of length matters little, but if the metre be adopted, it is no reason because a millitre of distilled water is supposed to weigh 1 gramme at 4° Celsius in vacuo, that butter, coals, diamonds, and wood should be compulsorily dealt with in metres or their decimal derivatives. I am the first to admit that in physics and chemistry there are undoubted advantages in having, so far as one can, a common relation existing between the various units, but that is no reason why we should combine to force on the public a system of weights, measures and money which is so much against nature that it hardly obtains currency in the countries of its adoption. In France, precious stones are to-day bought and sold in carats; firewood in cordes; milk in pintes; gravel in toises; grain, potatoes and charcoal in boisseaux; wine in barriques, feuillettes, demisetiers and chopines; wood for construction in pieds, pouces and lignes; beer in canettes and pots; sugar and coffee among the poor people are dealt with in livres, demi-livres, &c. Cattle dealing

is carried on in pistoles and écus, and not in francs. Finally, they have just issued a 25-centime piece, doubtless because it represents a quarter of a franc. In my opinion, the decimal system applied to weights and measures and money offers too limited a field for the operations of ordinary life; and I should be sorry to see it, with all its disadvantages, forced upon us by legislation to the exclusion of other systems, when the admitted advantages to be gained are so small.

I should now like to make a few remarks, if time will admit, on the present functions of electro-chemistry.

This is one of the most progressive branches of electrical industry; although striking advances are rare, constant improvements in detail are being made, and processes which have been long outlined are being developed into commercially practicable methods.

Probably there has been no step so noteworthy during the year as the announcement by Mr. James Swinburne of his invention of a new process for the reduction of metallic sulphide ores, which, with the collaboration of Mr. Ashcroft, he has put to test on a commercial scale. The process consists in treating the ores with chlorine, displacing the sulphur, which is recovered—the essence of the invention being the fact that this reaction takes place without the formation of chloride of sulphur; various precipitations follow, according to the metals present, the final result, after all the other materials have been extracted, being zinc chloride. This is electrolysed, the zinc being obtained in the metallic state, and the chlorine is ready to be utilised again. Thus the process is cyclic, and it is applicable to almost all kinds of ores, including the huge piles of waste which have accumulated as the result of less complete processes. This system may well prove of the utmost importance in metallurgy.

Another valuable process which has made considerable progress during the past year is the reduction of iron ores by means of the electric furnace. At Livet, in France, the process is in practical operation, generators of 1,200 H.P. each giving single-phase current at 30,000 amperes each, and driven by water-power, being employed. The output is 12 tons of steel per day. At these works ferro-silicon is also made from quartz, scrap iron and coke, at less cost than that of smelting, and copper pyrites is reduced to copper and iron sulphides rich in copper, and ready for the ordinary smelting process. Steel of high quality is similarly produced in Sweden at the rate of 1,500 tons per annum. With the Stassano process the expenditure of energy is said to be 3,000 H.P.-hours per ton of iron; but with the Ruthenburg system, it is said that 500 KW.-hours suffice, and that ores of poor quality can be treated. Large deposits of iron ore exist in Canada, remote from coal mines, but within reach of Niagara Falls, and it is said that a Canadian syndicate has been formed to work the Ruthenburg system with power derived from the Canadian Niagara Falls hydro-electric works.

Already in Canada the Betts process for refining lead is in operation at Trail, British Columbia, the daily production amounting to 7 tons of lead. The crude lead is used as anode in a bath of lead fluosilicate and fluosilicic acid; there are 22 anodes per vat, through which 4,000 amperes are passed, and the pure metal is deposited on the cathode, leaving the impurities, including the precious metals and copper, on the anode in a skeleton of spongy lead.

In a quite different direction electricity is being used for the purification of the water supply of towns. There are two installations of this kind in Germany—Schierstein and Paderborn—where the Siemens ozonising tubes are in use; air is charged with ozone by means of these and is passed up dripping towers, down which the water trickles, with the result that it is completely sterilised as regards all deleterious organisms. At Schierstein the capacity of the plant is nearly 50,000 gallons per hour, and the power required is 50 H.P., of which, however, only 27 is used for ozonising, the remainder serving for pumping, &c. The pressure used is 8,000 volts. The working cost is in all from 3½d. to 4½d. per 1,000 gallons.

By the Jaruti process water is electrolysed to give pure hydrogen and oxygen, consuming 115 KW.-hours per 1,000 cb. ft. A solution of caustic soda is used, with a perforated iron diaphragm to separate the gases.

At Stangfjorden, in Sweden, the Jebsen system is used for the manufacture of briquettes from peat. The latter is carbonised by heating with the electric current, derived from water power, and the tarry by-products are recovered.

The production of nitric acid from the atmosphere has long been the subject of experimental research; it is now in active operation at Niagara Falls, where by means of electric discharges at extremely high pressures and frequencies the nitrogen and oxygen are caused to combine. The same subject has been dealt with on the Continent, where a return of 52 to 55 grams of nitric acid per kilowatt-hour has been obtained, using a current of 0·05 ampere at 50,000 volts, and 6,000 to 10,000 cycles per second. As Sir William Crookes has shown, the fixation of atmospheric nitrogen may in the distant future have a most important bearing upon the existence of the vast population of the earth, when natural sources fail to furnish an adequate supply of food.

In connection with this subject, the synthesis of sugars by the electrolysis of carbonic acid, ammonium phosphate, &c., which has been accomplished by Walther, is of no little interest.

The extraordinary potency of electrolysis and the electric furnace in chemical and metallurgical processes has been most largely made use of in America, which is, in fact, the electro-chemical headquarters of the world. The various works which derive their power from Niagara Falls are producing caustic soda, chloride of lime, carbide of calcium, chlorate of potash, sodium and sodium peroxide, sodium cyanide, baryta, phosphorus, nitric acid, lead, carborundum, graphite, corundum, &c. A single American concern is producing 4,500 tons of aluminium per annum, while the United States produces 276,660 tons of electrolytic copper per annum, no less than 66·5 per cent. of the world's output. Siliconcon, a highly refractory compound of silicon, carbon and oxygen, is one of the latest products of Niagara. The electrolytic rectifier, which depends upon the peculiar properties of aluminium in an electrolytic cell, is a device which will have many applications, especially since it has been so arranged as to ingeniously utilise both positive and negative waves of an alternating current.

One of the most important branches of electro-chemistry is that which relates to secondary batteries, and, in spite of the immense amount of work which has been done in this direction in the past, remarkable progress has been made of late. The most notable invention in this department is the Edison nickel-iron cell, which appears to be on the verge of adoption on a commercial scale. Elaborate machinery has been designed and constructed at great cost for the rapid manufacture of the cells, and trial cells have been in the hands of European experts for many months, while complete sets have been exhaustively tested in America and England. There seems to be no question that the cells have fulfilled the claims made for them, and that their introduction in quantity will give an immense impetus to the electric automobile industry, and even to accumulator traction in general. The cleanliness, capacity and seeming indestructibility of the cells, joined to their highly perfected mechanical construction, render them admirably adapted to automobilism, and the stated ability to charge them with 75 per cent. of their full capacity in one hour is a feature of the first importance.

Other cells have been brought forward, notably the Elieson cell, which is an improved lead plate cell, with the property of enduring remarkably high rates of charge and discharge without injury, and the "N.S." (Niblett Solid) cell, in which the whole of the positive and negative elements are packed tightly in a container. Each of these has meritorious features, but whether they will stand the test of time cannot yet be decided.

Besides the foregoing examples, a vast amount of work is being done in every branch of electro-chemistry, and the recent formation of the Faraday Society, admirably named, to further the interests of the science and industry in this country—long after the birth of similar societies abroad, it is true—can well be included as one of the most important and fruitful "recent developments" in the electrical world.

I will now bring this address to a close, as I began it, with a reference to the growth of this Institution.

In my opening remarks I omitted an observation which I should have made concerning this growth, and that was in reference to the source from which our members are drawn. Had not a great wave of educational fervour passed over this country some 20 years ago, had not the establishment of technical institutes all over the country taken place, had not Lord Kelvin, and others, educated their pupils in a way which best fitted them for the position of efficient teachers in these technical colleges, our Institution would not have attained its present importance, and the posts filled by many of its members would, perforce, have been filled by the better educated foreigner. It is a great advantage to the taught that their teachers should be concerned with the practical side of the subject they treat, and this in itself is a justification for those who teach, being members of our Institution and taking an active part in its management. Teaching from text-books which are written on an undeveloped science causes the student to learn many things that he has to unlearn, and launches him into the world full of information which may have been abandoned altogether, or is at least five or six years old. If the teachers are in touch with everyday practice the taught profit immensely, and leave their colleges with knowledge which, although it may later require modifying, has, at any rate, the advantage of being the knowledge of the day. I believe the electrical industry in this country is almost entirely in the hands of electrical engineers educated in England. Can this be said of the chemical industry? I doubt it, and presume that it is because the latter is a much older science, and has not been favoured in possessing in this country so many educational advantages as are offered to those engaged in the electrical industry. It certainly has not, as a general body, had teachers with the same practical experience, although there are undoubted signs that the younger generation is being better taught. To cite one instance in my personal knowledge, out of the many which might be selected: I remember my father introducing into Scotland, for the purposes of calico printing and dyeing, the use of certain coal-tar dyes, the employment of which had just been made practicable by Mr. W. H. Perkin. Forty-five years have elapsed since then: and, although Great Britain has practically been the home of the raw material, and one of the greatest consumers of these products, yet, through the application of greater knowledge and skill, Germany to-day furnishes our printers and dyers with the greater proportion of their requirements. We are being beaten in a race in which the foreigner is handicapped. Is this due to the natural incapacity of the Englishman, or is it due to the want of the opportunities which his foreign competitor possesses? Despite the opinion recently expressed by Prof. Karl Pearson, I like to accept the latter explanation, although, given the opportunities, we must always bear in mind that a chemist's work is laborious in the extreme, and this may not as a rule satisfy the ordinary class of English student. In adopting this illustration, I do not wish to be misunderstood. I have no intention of implying, and it would be foolish to imply, that this country does not possess chemical knowledge of the very highest order, as witness the number of distinguished men whom we know by name, and the work they have done, and also the large number of chemical works established in London, Manchester, Glasgow and other districts. I also fully recognise that the chemical industry cannot be fairly compared with the electrical industry, as it occupies a much wider field, and is a much more difficult subject to master. I use the illustration, as I do not believe the mass of people engaged in the industry have placed at their disposal sufficient opportunity for proper instruction, or for acquir-

ing knowledge, as is the case in Germany and some other countries.

With wisdom, we in this country open our arms to the skilled man of other countries, and through his skill we can, in certain directions, maintain supremacy in some of our productions. The pity of it is that we have not amongst our own countrymen men of equal education and skill. One may say that the electrical industry is also suffering, and that the signs of it are the large importation of American and German machinery into this country at the present time; but I venture to disagree. Americans and Germans are doubtless appearing on our markets, and, in many cases, owing to greater skill in manufacture; but the financial side of the question has a great deal to do with their incursion, and especially is this so with their competition in our Colonies and in non-manufacturing countries.

We must, as a policy, continue to welcome all comers, but while so doing we should equip ourselves so that by sheer skill and ability we may conquer in the end. The equipment we require is, everyone now admits, technical education, and this we are developing in all directions. The electrical engineers as a class are better equipped than any other class I know of, thanks to the teaching received in our technical institutions from very capable men, some of whom we are proud to see numbered among the Past-Presidents of this Institution.

During the recess several powerful advocacies for the furnishing of greater educational facilities to the students of this country have been published, and it is gratifying to see that these publications were made in a manner to bring them before everyone who cares to read them. Sir Norman Lockyer, in his presidential address to the British Association Meeting at Stockport, made a stirring appeal, which must sink into the soul of every thinking man who has the welfare of his country at heart. Sir William Abney, as chairman of Section L.—Educational Science—placed before the public what has been done since 1853 by the Science and Art Department with the small amount of funds at their disposal. Prof. Meldola's lecture, delivered in August last at Oxford, on Chemical Industry and Research, should also be mentioned, as it deserves careful reading.

Opportunely, Prof. H. E. Armstrong has just had published by Macmillan & Co. a collection of his writings on Education. Sir William Ramsay, the President of the Society of Chemical Industry, and many others who are interested in industrial development, are actively forwarding the cause; and it is to be hoped that some good may be evolved from the atmosphere of public interest which has been created, and that we may thus eventually find the men of this country as well furnished as their foreign competitors with the necessary knowledge, and with the means of applying it in investigation. Our Past-President, Dr. John Perry, informs me that there is under consideration the formation of a Science Guild, whose fundamental object will be the encouragement of the application of scientific principles to industrial and general purposes. We must all hope those engaged in the matter will succeed in founding this Guild, as there doubtless exists a blank which it can fill.

I am glad to see some of our members—notably my predecessor, Mr. Swinburne, and our Honorary Member and Past-President, Mr. Swan—are interesting themselves in the formation of the Electro-Chemical Society, to which I have already referred; and I am sure we all wish them every success in their effort to specialise this very important subject in Great Britain.

For the future development of the usefulness of the Institution there appears to me to be one matter worthy of our utmost attention. The Institution membership extends all over England and the Colonies, and we have found it a useful addition to our constitution to establish local sections in different centres. Since these sections have been formed, many valuable contributions have been incorporated in the *Journal of the Institution* which might not have appeared there, had the opportunity of having a meeting-place in the author's neighbourhood been absent, and had there not existed an organised assembly to discuss the subject submitted by him. The local sections are growing, and must by the nature of things increase in importance. The development of the electrical industry in the provinces must advance with greater strides than in London, where manufacturers are hampered by high local rates, and sometimes obstructive legislation, which appears to be a necessity in our large Metropolis, and which is, fortunately, not so essential in smaller communities. Again, in the neighbourhood of London the cost of raw material is appreciably higher; fuel is also higher, and the charges for the transport of the finished goods to their destination handicaps the London manufacturer. These, in addition to the higher scale of wages paid, are fast driving manufacturers into the provinces. Such a migration, from a general point of view, is perhaps advantageous; but it indirectly affects the Institution in a way which is not of advantage to the central body. If the migration continues to the same extent as took place in the case of London shipbuilding many years ago, the centre of production, so to speak, of the electrical industry will gradually gravitate northwards, and nothing but consumers will be left in the Metropolis. Many of our ablest members are already in the provinces, and it is quite a question for the Institution to consider whether the day is not fast approaching when we should extend our system of decentralisation. Is it not time that we should consider the establishing of a local section in London, similar in all respects to the local sections we have in Birmingham, Dublin, Glasgow, Leeds, Manchester and Newcastle? In this new local section papers affecting London could be read, and be published or not in the Journal of the Institution in the same manner as papers in the other local sections are dealt with. London would continue to be the headquarters of the Institution, and Institution meetings could be held, say, four times a year. At these, papers of general interest could be contributed. If any such scheme as this were adopted, the constitution of the Council of the Institution would be somewhat affected. The chairman and committee of the London local section would, of course, be all London men, but the Institution would have a larger field from which to select its president and council, as men who have their business in the provinces, and who cannot spare the time to attend the present numerous Council and Institution, might be able to attend the less numerous meetings which would be the outcome of some such rearrangement.

In conclusion, I must thank you for the kind tolerance with which you have received the remarks that I have had the pleasure of submitting for your acceptance.

THE EDISON ACCUMULATOR FOR AUTOMOBILES.

By W. Hibbert, Associate-Member.

(*Paper read November 26th*, 1903.)

The problem of making an accumulator with an alkaline electrolyte has been before the world for many years, and has been attacked by a fairly numerous body of workers. It is known that Mr. Edison is one of this number, and various public statements have appeared as to the results of his labour. Most of these can be neglected as void of authority, but the account published by Dr. Kennelly before the America Institute of Electrical Engineers was evidently based on carefully executed work. From this paper we learned the general nature of the cell, together with certain useful numerical data. 14 watt-hours were obtained from 1 lb. weight of the cell, the average E.M.F. being about 1·25 volts.

It is not necessary to repeat here the other data from Dr. Kennelly's paper, as they will be brought up to date by the facts to be quoted from my own tests. It is sufficient to say that very little was done during the next year. The matter seemed to fall into the background, and public opinion settled down to a vague belief that the cell had not yet reached the commercial stage. Indeed, I have heard doubts expressed as to the very existence of the cell. To some extent I shared this scepticism, not because I doubted the existence of the accumulator, but because of its constitution. I doubted (and expressed my doubts in print) whether the plates would be altogether free from local action, and whether a very small amount of this weakness would not be sufficient to destroy the plate. These fears were based on the data afforded by Dr. Kennelly's paper, more especially the thinness of the plates, and also the probable results of mixing graphite with the active material.

Such anticipations were, I suppose, quite legitimate as anticipations, but they have not been justified by the results of actual trial. It is one of the striking features of the cell, that it recommends itself by work more than can be done by any verbal account.

In the early part of this year, I obtained three of Mr. Edison's cells of small size, and in early June was provided with a Standard Automobile cell. Finally, during part of my summer vacation I was able to run about 500 miles on an automobile driven by 38 Edison cells. The general results of the work done on all these will be described in this paper. I shall confine myself to a somewhat simple statement of the facts verified by myself, feeling sure that these will be most acceptable to the members of the Institute. But it may be worth while mentioning that well-known men at Milan, Paris, &c., have obtained laboratory results which agree in all the main particulars with my own. They have not as yet had the opportunity of testing on the road. A brief description of the cell will be advantageous.

Standard Automobile Cell.—This contains 14 positive and 14 negative plates. Each plate is made of sheet-steel, nickel plated, punched with 24 holes of rectangular shape. In each of these holes is inserted a flat pouch or pocket containing the compressed active material. The walls of these pockets are perforated by exceedingly fine slots or holes, through which the liquid can penetrate. Thus the current can easily pass to and from the active material contained in the pockets.

Active Materials.—Both positive and negative plates are alike, except in respect of the active material. The pockets on the positive plate contain nickel peroxide; those on the negative plate contain finely divided iron. Each of these active materials is, I understand, mixed with flake graphite.

Electrolyte.—The liquid is a 20 per cent. solution of potash.

Arrangement.—The plates are fixed very near each other. Yet there does not seem to be any danger of short circuits. The plates are thin, it is true, but being made of steel, they are thick enough to give rigidity. As a further precaution, vulcanised rubber separators are put between the plates, making the whole a compact mass, whose stability is calculated to resist all the ordinary mechanical shocks it is likely to undergo.

External arrangements.—The cell is sealed in its steel case, the top being fixed on by a special solder not acted on by the potash. Two stout connecting-pins (from the positive and negative plates respectively) come through liquid tight bushes of vulcanised rubber. These pins are made slightly conical, as are also the connectors which fit on them, and the mechanical finish and easy grip of this terminal add to the value of the battery. The connector is further secured by a screw-nut and fastening-pin. The connector has a much higher conductivity than those of the ordinary type of accumulators.

On the top of the case there are also:—

(*a*) A spring stopper with rubber flange, covering the hole by which the electrolyte is introduced, or distilled water added from time to time.

(*b*) A vent hole guarded by a gravity valve. This provides for the escape of the gas evolved during charge. The hole and valve are covered by a gauze nipple, which prevents escape of spray while allowing gas to pass. It also prevents any flame finding access to the interior of the cell through the stream of evolved gas.

The complete cell stands 13 in. high (over all) and measures 5·1×3·5 in. horizontally. It weighs 17·8 lbs. A large part of the external steel case is corrugated to increase its rigidity.

An immediate consequence of examining these features of the cell is to impress the observer with their admirable fitness—perfection is hardly too strong a word. That which is so lacking in ordinary accumulators—mechanical strength or design—is here in obvious and large measure. The general mechanical structure of the cell is well calculated to remove or to diminish any antecedent adverse opinion.

Electrical Data —The E.M.F. is 1·33, though, as there is a very persistent gaseous polarisation effect, the figure cannot be regarded as quite rigid. For a long time after charging it is much higher. The internal resistance is 0·0013 ohm. The output at 60 amperes is 210 watt-hours = 11·8 watt-hours per lb.

The following diagram (fig. 1) shows the arrangements used for charging and discharging :—

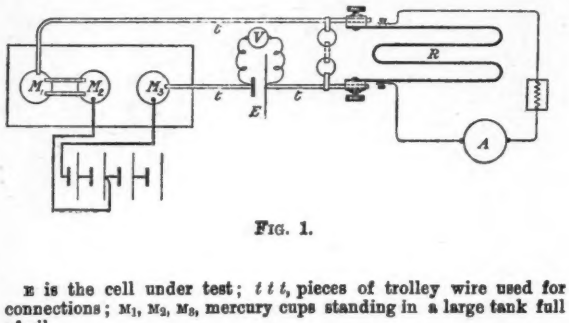


FIG. 1.

E is the cell under test; *t t t*, pieces of trolley wire used for connections; M_1, M_2, M_3, mercury cups standing in a large tank full of oil.

R, a standard resistance = 0·01009 ohm, verified by the Board of Trade.

V and A, voltmeter and ammeter, both re-calibrated for these experiments.

Large lead accumulators were used for charging E. For the purpose of charging, constantan resistances of varying value and diameter were used to bridge M_1, M_2; for discharging, it was necessary to bridge M_2, M_3 as well. The control of either strong or weak currents was quite easy and rapid by putting constantan wires in parallel across the mercury cups. In very few of the experiments did the current vary as much as 1 per cent. The average variation was probably about 0·3 or 4 per cent.

The curves in fig. 2 tell their own story.

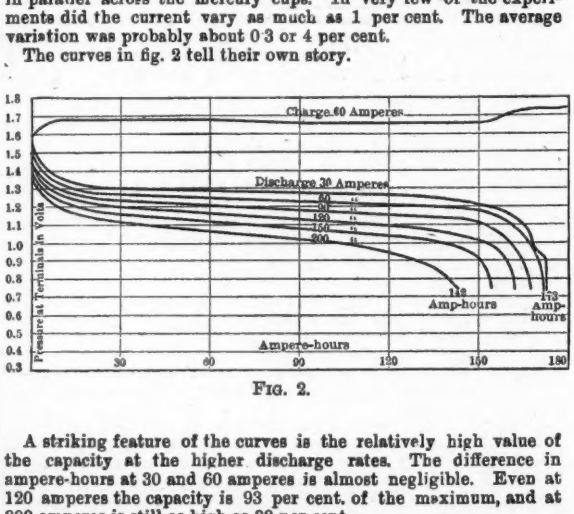


FIG. 2.

A striking feature of the curves is the relatively high value of the capacity at the higher discharge rates. The difference in ampere-hours at 30 and 60 amperes is almost negligible. Even at 120 amperes the capacity is 93 per cent. of the maximum, and at 200 amperes is still as high as 82 per cent.

These results at once indicate a valuable feature of the cell for many of the emergencies of engineering. That the quantity obtainable at the high rates should be such a large proportion of that possible at low rates is both surprising and agreeable.

Output.—In relation to the weight of the cell the work done is higher than usual. Taking the output at 210 watt-hours,* and the weight at 17·8 lbs., the specific output amounts to 11·8 watt-hours per pound of cell. This must be regarded as a high figure. It is true that nearly equal figures have been obtained with other cells, but confessedly at considerable risk. The weight of lead cells is reduced by making the supports very thin, but this shortens life. Output can be increased by using stronger acid, but this leads to rapid loss of charge if the cell stands idle. These serious risks do not accompany the method of getting high specific output in the case of the Edison cell. It is, as we shall see, able to retain a large proportion of its charge for a long time, and its relation to "life," although not yet fully verified by my work, is one of very considerable security as far as can be judged by the results already obtained. In relation to volume, the specific output is 1,564 watt-hours per cubic foot.

Influence of Temperature on Output.—In the case of lead cells this is very marked. With the Edison cell no definite series of experiments has been made, but accidental circumstances afford evidence of some interest. Some discharges were taken on two of the few very hot days of last summer. The high temperature of the air, added to the heating effect of the currents, caused the temperature of the cell to rise very high. With a current of 150 amperes, it reached 54° C. The output rose to 163 ampere-hours, some 9 ampere-hours more than were obtained at a temperature of 33°. This is an increase of 5·5 per cent. in capacity for a rise of 21°, or an increase of 0·26 per cent. per 1° rise.

Other experiments, not specially designed to test the point, indicated a detectable but small increase. The effect is, however, very much less than with the lead cell. With them it may be 2 or 3 per cent. per degree Centigrade. With the Edison cell, a few degrees difference in temperature would produce hardly any change in the quantity output.

This difference in the effect of temperature doubtless arises from the difference in the nature of the actions going on in the respective electrolytes. The continued working of the lead cell demands a continued supply of the acid at the internal working faces of the porous materials on the plates, and a rise in temperature helps to provide this by increasing the rate of diffusion of acid from the outside. In the Edison cell there appears to be practically no need for diffusion or circulation of the liquid. It is not an active material in the ordinary sense; it acts only as a conductor. Hence a higher

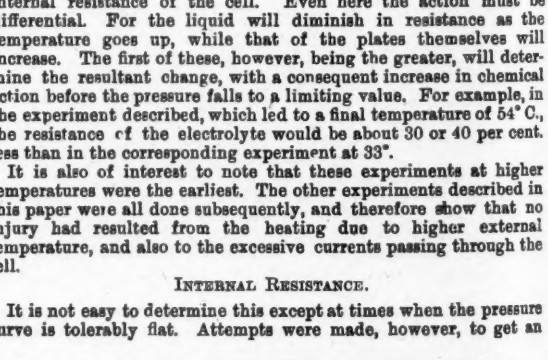

Small Edison cell. Discharge at 0·15 ampere.
A. Normal discharge.
B. First discharge following 46 hours short circuit.
C. Second " " " " "
Time in hours.

FIG. 3.

temperature cannot change the action except by diminishing the internal resistance of the cell. Even here the action must be differential. For the liquid will diminish in resistance as the temperature goes up, while that of the plates themselves will increase. The first of these, however, being the greater, will determine the resultant change, with a consequent increase in chemical action before the pressure falls to a limiting value. For example, in the experiment described, which led to a final temperature of 54° C., the resistance of the electrolyte would be about 30 or 40 per cent. less than in the corresponding experiment at 33°.

It is also of interest to note that these experiments at higher temperatures were the earliest. The other experiments described in this paper were all done subsequently, and therefore show that no injury had resulted from the heating due to higher external temperature, and also to the excessive currents passing through the cell.

Internal Resistance.

It is not easy to determine this except at times when the pressure curve is tolerably flat. Attempts were made, however, to get an

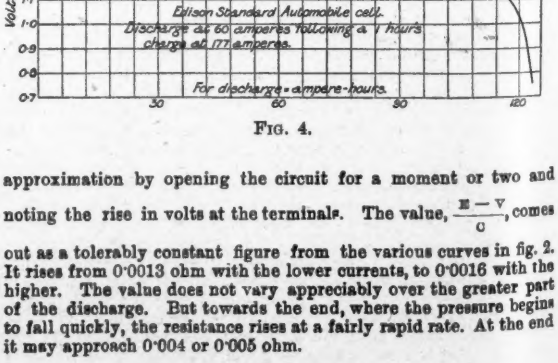

Charge
For charge = minutes.
Discharge.
Volts at terminals
Edison Standard Automobile cell.
Discharge at 60 amperes following a 7 hours charge at 17·7 amperes.
For discharge = ampere-hours.

FIG. 4.

approximation by opening the circuit for a moment or two and noting the rise in volts at the terminals. The value, $\frac{E-V}{C}$, comes out as a tolerably constant figure from the various curves in fig. 2. It rises from 0·0013 ohm with the lower currents, to 0·0016 with the higher. The value does not vary appreciably over the greater part of the discharge. But towards the end, where the pressure begins to fall quickly, the resistance rises at a fairly rapid rate. At the end it may approach 0·004 or 0·005 ohm.

Short Circuit.

With the object of testing the power of recovery, one of the small cells was partially discharged, and then short-circuited for 48 hours. After a subsequent long charge it gave the discharge curve B, fig. 3. Compared with the normal discharge curve A, B indicates a deficiency. It is evident that the cell has not yet recovered. On charging again, however, and taking a second discharge (curve C), the deficit hardly appears; the cell has practically recovered from the harsh treatment to which it had been subjected.

* This is at 60 amperes: at 30 amperes the output is somewhat higher.

High Rate of Charging.

The foregoing experiments prove conclusively that the Edison cell can maintain a high rate of discharge. The interest of this question hangs on its maximum charging rate, and this I have not been able to reach. The accompanying curves, fig. 4, show the course of an experiment made to test this point. The cell was first carefully discharged at 30 amperes down to 0·75 volt. It was then charged for one hour, 177 ampere-hours being put in. The current was not quite steady, varying from 180 to 176 amperes over most of the time. Near the close of the hour it fell to 166 amperes. The subsequent discharge shows that 124 ampere-hours were delivered, which equals 70 per cent. of the charge.

Further experiments on this point appear in the later section dealing the motor-car work, proving that the cell can be charged at over 200 amperes.

(To be continued.)

Abstract of Mr. Gerald Stoney's Address to the Newcastle Local Section.

(Delivered Monday, November 16th, 1903.)

This branch of the Institution of Electrical Engineers has now been in existence for four years, and the membership has risen steadily from 93 at the time of its inauguration to 152 at the present time.

A subject in which great interest is being taken is the education of engineers; all are practically unanimous that it is necessary to combine practice with theory, and the best way of doing this seems to be the "sandwich" system, in which the theoretical and practical training are carried on concurrently. Stress should be laid on the importance of letting a boy early in life learn the use of tools. Modern languages also are of great use to an engineer, and he should be taught both to read and speak them. Latin and Greek may well be left out; the German grammar is as good an education for the mind as the Latin grammar, besides being of practical use. Mathematics should be taught so as to enable the student to make use of them in the actual problems which occur in practice. In thus, however, urging a practical education for an engineer, no one more than an engineer is aware how much is owing to those who pursue science for itself apart from mere monetary gain. In almost all cases the way has been paved for the engineer and the commercial man by seekers after knowledge, which they have given to the world freely and without stint.

The distribution of electricity for power, lighting and traction has made enormous advances, and there is no sign of this rate of progress slackening. In this district we have the first of the great power stations at Neptune Bank, Wallsend-on-Tyne, and soon a second one at Carville will be at work. During the past 15 years the size of engines and dynamos used has steadily risen from about 100 kw. to from 4,000 to 5,000 kw. at the present date. In this connection the Parsons steam turbine has taken a notable part. This was invented by the Hon. C. A. Parsons, F.R.S., in 1884, and the first engine was of about 10 h.p., while now turbines up to 8,000 and 10,000 h.p. are being made. The low first cost, small steam consumption, absence of reciprocating parts, and small foundations, as well as reduced attendance and upkeep, have made this type of engine largely adopted for driving dynamos and alternators, as well as for the propulsion of ships and other purposes.

A great field is opened up by the discovery of cathode and other rays, in which we seem to be dealing with individual electrons instead of with masses of them. These researches in molecular physics may some day enable us to tap the great source of energy existing in the atmosphere, by the help of the "Sorting Demon" pictured by Clark Maxwell, and thus utilise for the service of man the energy of the atmosphere without the consumption of coal or other fuel; and looking back on the advance made in the last 100 years, who will say it is impossible?

Manchester Section.

On Tuesday, November 17th, the first meeting of the present session was held at Owens College, and a very large number of members and friends were present. A very interesting address was given by the chairman, Mr. Edw. W. Cowan, dealing mainly, and at considerable length, with the fiscal question as it affects electrical engineers. Afterwards a brief demonstration was given by Dr. Schuster (of Owens College) on the properties of radium and other radio-active bodies.

It was shown, by experiment, that when a lighted taper or other flame is brought near to a charged electroscope, the leaves fall together almost immediately, due to the flame making the air a conductor. A piece of radium and a piece of pitch blende (from which ore radium is obtained) had the same effect. Another experiment showed the same thing in a different manner; this was to cause a spark, which was previously arranged to pass across either of two air gaps, sometimes taking the one sometimes the other, to pass only across the air gap which the radium happened to be held nearest to. Dr. Schuster stated that it appeared that radio-activity is due, not to the mere existence of a radio-active body, but to the fact that change takes place in the atoms of the substance. The emanation given off by such substances is apparently a gas, in very small quantity, and this gas can be solidified at about the temperature of liquid air.

Radium was shown, by darkening the room, to be plainly phosphorescent, and it was said that the radium must be dry, otherwise it could not be phosphorescent. Radium, thorium, uranium and polonium, the lecturer stated, are all radio-active, and, no doubt, many other substances also; polonium has, however, not been experimented on much as yet.

As regards the commercial use of radium for power or lighting purposes, Dr. Schuster could hold out no very bright prospects for electrical engineers at present. Speaking of power, he said that the cost of 1 h.p. would be rather excessive, even though, once obtained, it would be available for a thousand or a million years; it would take about 160 lbs. of radium to give off 1 h.p., and the price of this would be about £80,000,000—rather a heavy capital expenditure for the power obtained. With regard to lighting, the tiny sample he showed giving phosphorescence cost £6; this, also, appeared to be somewhat a heavy price to pay. The changes which take place in the atoms of these radio-active bodies, we have, at present, no control over; low and high temperatures, enormous pressures, chemical combinations with other bodies, alike have no effect in altering their activity. There is just the hope held out by the speaker for electrical engineers that some day it may be possible to enormously accelerate the rate at which energy is given out, and also reduce the cost of the material. For instance, if radium capable of giving 1 h.p. continuously for, say, a million years, could be made to give out that vast energy in one year, and if the cost were at the same time reduced to reasonable proportions, then it would be possible to use radium as a source of energy on a commercial scale.

The lecture was throughout listened to by all present with the greatest interest, and a very hearty vote of thanks was accorded to Dr. Schuster.

The next meeting will be held on December 15th, when Mr. A. C. Eborall will read a paper on "Polyphase Electric Traction."

THE CONSERVATOIRE DES ARTS ET METIERS.

On July 1st of the present year, the Laboratoire des essais du Conservatoire des Arts et Metiers was formally opened in Paris by the President of the French Republic. Although electrotechnics are expressly excluded from the work of the Institution, a brief account of the aims and equipment of the laboratory will be of interest to the readers of the Electrical Review. The Conservatoire was originally established in 1799 in the Priory of St. Martin-les-Champs as a museum of machines, models, &c., and courses of lectures were organised in connection with it. In 1901 the offices of Patents and Trade Marks were transferred to the same building, and since then the testing laboratory has been added. The laboratory is State-supported, and has also received valuable grants from the French Society of Civil Engineers and other bodies. The main building of the laboratory has been specially erected in one of the courts of the Priory, and part of the basement of the surrounding building is also utilised.

The laboratory is divided into five departments under the supreme direction of M. Perot. In the section devoted to physics, the verification is undertaken of weights and measures, barometers, thermometers, optical apparatus and the like.

The second department is being very completely equipped for the testing of metals. The testing machines include a 300-ton horizontal Universal machine, which is being built by Messrs. J. Buckton & Co., of Leeds, and which will be capable of dealing with test pieces 25 metres long. Besides this, there are three other and smaller machines for testing metals, a 4-ton machine for tests on india-rubber, and machines for testing wires, &c. The department is also equipped with muffle furnaces for the heat treatment of metals, an electric arc furnace for melting alloys, and an apparatus for photomicrography.

The third department is for the testing of materials of construction other than metals, such as cements, stones, bricks and glass. It is very completely equipped for making the materials, and for all kinds of tests on their strength, durability under all conditions of use, porosity, &c.

The fourth department is intended for the study of all kinds of machinery, such as boilers, steam engines, turbines and motor-cars. It is equipped with five Belleville boilers, a 35-H.P. engine, a superheater, and surface and jet condensers. For gas engines, a plant for making gases from various fuels has been installed, and is of a capacity sufficient for the supply of machines of 20 H.P. The department is also provided with an apparatus for testing the horse-power, &c., of auto-cars at all speeds up to 100 kilometres per hour.

The last section deals with vegetable substances, chemical, micrographic and other tests on woods, manufactured india-rubbers, oils, and the like; and the department is intended to act in conjunction with, and amplification of, the mechanical tests made in other departments.

As explained above, electricity is excluded from the purview of the Institution. It is, however, extensively utilised for lighting the buildings, for driving the numerous machines, and for experimental purposes. Particular mention may be made of small furnaces used for the examination of the properties of substances at high temperatures. Of these, two are furnaces of the resistance type, one vertical and the other horizontal. Temperatures exceeding 1,200° C. can be maintained in them. The furnace consists of a porcelain tube, round which is wound a spiral of platinum ribbon 13 mm. wide and ·007 mm. thick, with a suitable covering to keep down radiation to a minimum. This form of coil in preference to a wire reduces the weight of platinum required, by increasing the general efficiency of the furnace, to a very small quantity, the horizontal furnace, which is 60 cms. in length and 5 cms. inside diameter, containing only 20 grammes of platinum. The third furnace is an arc furnace of a type invented by M. Gabreau. It is intended for melting metals in small crucibles. There are two pairs of arcs, each pair being in series and taking 110 volts, and so arranged that the heat is concentrated on the crucible. The latter is supported on a long vertical rod of refractory material passing through the bottom of the furnace. By means of a motor, this rod, and with it the crucible, is continually rotated, and at the same time the rod is made to move up and down by an electro-magnet, of which the circuit is alternately made and broken by a commutator worked by the motor. In this furnace 300 grammes of nickel have been melted in 16 minutes, starting cold.

TENDERS IN THEIR LEGAL ASPECT.

The correspondence which has recently taken place in these columns with regard to tenders, appears to show that, however much time and energy is expended upon preparing specifications and making tenders for the performance of electrical contracts, this method of obtaining business is likely to continue to find favour in the future. The contract by tender has the advantage that it enables the contractor to make a careful survey of his liabilities before he actually signs any binding agreement with the employers. He, at any rate, knows the probable cost of the work, and can make a rough estimate of the profit which he is likely to make if his offer is accepted.

But it is important for every contractor who makes a tender to clearly understand the legal position in which his tender places him. Circumstances may alter after the tender has been posted, in consequence of which he may desire to withdraw the document. Can he do so? If he makes a tender, he not unnaturally requires to know whether he has any remedy against the employers if they refuse to accept it. Finally, he may wish to know his position as regards other contractors who have sought for, and succeeded in obtaining, the contract by the same means which he has adopted. These questions, and many others similar to them, have arisen in the past. It may be convenient, if we refer to the principles of law according to which they are likely to be dealt with by the Courts.

A tender is an offer to do work at a certain cost based upon specifications which are sent out by employers. As a general rule, the advertisement for tenders contains a statement to the effect that "the company (or as may be) do not undertake to accept the lowest or any tender." If this advertisement appears, and a tender is made upon the strength of it, the lowest tenderer has no cause for complaint if he fails to get the contract. If no such disclaimer is made, however, it is a nice question whether there is not an undertaking on the part of the advertisers to accept the lowest tender.

First, as to the making of a tender. A man who tenders sometimes repents before his tender is accepted. It is useful to point out that an offer or tender may be revoked at any time before it is accepted. The retractation must, however, be received by the employers before their acceptance has been posted; for the acceptance of an offer is deemed to be received as soon as it is posted.

A tender is usually made in writing, but it is not necessary that the tender should be in the tenderer's writing, providing the other circumstances are sufficient to identify the tenderer.

In a case which was heard many years ago, a railway contractor met a number of persons, one of whom we may call A, in order to receive tenders from each of them as to the execution of certain work. He read the specification with reference to the work; and after this A handed in his tender with the others. His tender was signed with his name, but there was no evidence that it was in his handwriting. It was held, notwithstanding, that such tender taken with the specification sufficiently proved the contract. Allen *v.* Yoxall (1 C. & K. 315).

It is important to notice that a tender and acceptance may amount to a contract, although the acceptance refers to a formal contract to be drawn up afterwards. So if an electrical contractor were invited to tender for certain work, and he made his tender and received the following reply from the employers:—"We accept the tender. The contract will be prepared by our solicitors," this would form a complete contract (see Lewis *v.* Brass 3 Q.B.D., 667). This rule, however, does not hold good if it be made clear that the employers will require a written document. In the case of Kingston-upon-Hull (Governors) *v.* Petch (10 ex. 611), the Guardians of the poor had issued an advertisement stating that they would receive tenders for the supply of the Workhouse with meat for three months, from 30 to 50 stone (setting out the description of meat), that sealed tenders were to be forwarded, and that all contractors would have to sign a written contract after acceptance of the tender. A butcher wrote to the Guardians as follows:—"I propose to supply your house with meat according to advertisement for the next six months at 6d. per lb." His proposal was accepted, and he was informed that he was appointed butcher, upon which he immediately declined the appointment. It was decided that the transaction amounted merely to a proposal for a contract, and that there was no binding agreement until a written document was signed.

A most important question arises as to the validity of an agreement amongst a number of contractors not to tender for a particular piece of work. This course is sometimes adopted in order to leave the field clear for an independent contractor who may be under agreement to share profits with those who have stood out of the way. The principle that such an agreement is not void was declared in the case of Jones *v.* North (19 L.R. Eg. 426.) There it appeared that tenders for the supply of stone were invited by a corporation. Four neighbouring quarry owners entered into an agreement that they should each supply a certain proportion of the stone, and that the plaintiffs should make the lowest tender to the corporation. The plaintiffs entered into contracts with the other quarry owners to purchase the proportion of stone agreed upon from each. Notwithstanding the agreement, one of the quarry owners sent in a tender which was accepted by the corporation. The other quarry owners who had been parties to the agreement thereupon applied to the Court of Chancery for an injunction to restrain the supply of stone to the corporation by the defendants. It was held, over-ruling an objection by the defendants, that the agreement was not void either as against public policy or upon any other ground.

An agreement not to tender in competition, extends apparently to work other than that which may be within the immediate contemplation of the parties at the time of the contract. Thus, suppose two electrical contractors agreed not to tender in competition with each other for the supply of goods or machinery to a certain Corporation. This agreement would not be satisfied merely by their recognition of it in respect of one tender. In the case of Metcalf *v.* Bouck 25 L.T. 539, an agreement was made between A and B not to tender in competition with each other for gas tar. In answer to an advertisement, and acting upon his agreement with B, A sent in a merely nominal tender, with the result that B got the contract. Later, fresh advertisements were issued and a tender by B was rejected, whereupon A, without communicating with B, sent in a tender on his own account. It was decided that the agreement between them

was still pending, and that [A] was liable for the breach of it.

It may be stated that, as a general rule, there is no implied undertaking in an advertisement for tenders to the effect that the lowest tender will be accepted. This rule, however, only holds good where there is no custom of the trade to the contrary. In the case of Pauling *v.* Pontifex (1 W.R., 64) the plaintiff sent to the defendants' agent a tender for the execution of certain buildings. It was held that the judge was right, having regard to the evidence, in concluding that, according to the custom of the trade, the plaintiffs' tender being the lowest it had been accepted, although their agent had no absolute authority to accept the lowest. In a later case, however, an attempt to establish a custom met with failure. There the defendants had issued a circular in which it was stated that they had been instructed to offer to the wholesale trade for sale by tender the stock-in-trade of a certain firm, which they announced would be sold at a discount in one lot. They also stated in the circular the day and the hour when the tenders would be received and opened at their offices. The plaintiffs made a tender which they alleged was the highest. In an action against the defendants for not accepting such tender it was decided by the Court that the circular was only an invitation for offers, and that there was no implied undertaking by the defendants to accept any tender at all.

We are confident that no "custom" to accept the lowest tender could be set up in the electrical world, although it may be and often does turn out that the lowest tenderer is successful. Yet a tender must be *bonâ-fide*, and not in any way likely to open the door to fraud. For instance, suppose employers agreed to accept the lowest tender for the erection of an electric lighting station, and that a contractor sent in a tender by which he undertook to do the work for, say, a less sum by £100 than any sum mentioned by any of his rivals. It is submitted that the employers could not be compelled to give him the contract.

This submission is based upon the case of the South Hetton Coal Co. *v.* Haswell (1898) 14 T.L.R. 277), which differs in that the question there arose in connection with the purchase of royalties due from certain collieries. An offer was made to accept "the highest net money tender they should receive (all other things being equal) from one of two rival purchasers. One party offered a certain sum; the other offered such a sum as would exceed by £200 the amount offered by the other proposing purchaser.

Upon a refusal on the part of the employers to accept this offer, an action was brought for specific performance. The Court refused to grant a decree. Lord Lindley, then Master of the Rolls, when the case came before him in the Court of Appeal said:—"The plaintiffs' offer is illusory, it does not answer to the description of the highest money tender either in the business sense or in the legal sense of the words. To hold that the plaintiffs' offer answered that description would be to encourage trickery and chicanery. It would be opening the door to the grossest fraud, not only towards purchasers, but towards vendors also.

The point decided by this case is somewhat narrow, inasmuch as the employers there expressly undertook to accept the highest. In the ordinary case of a tender to do electrical work, we cannot see that an offer to do the work for £200 *less* than any other contract would be open to objection from a legal standpoint, though we can hardly believe that any municipality or company would accept such terms. Furthermore, as undercutting is not an unknown practice, a tenderer quoting "so much lower than the lowest" may run considerable risks.

PHYSICAL SOCIETY.

Meeting held November 13th, 1903.

Dr. R. T. Glazebrook, F.R.S., President, in the Chair.

Sir Oliver J. Lodge read a paper on "Means for Electrifying the Atmosphere on a Large Scale." Twenty years ago the author was engaged with Mr. J. W. Clark on an investigation of the dark spaces seen near hot bodies placed in illuminated smoke. The existence of these dust-free spaces was discovered by Tyndall, and the phenomenon had been investigated by Lord Rayleigh. Tyndall worked with high temperatures, and attributed the effect to the burning of the dust near the hot body. Such, however, cannot be the case, as the spaces exist when inorganic dust, such as oxide of magnesium, is used. The conclusion at which Messrs. Lodge and Clark arrived (see *Phil. Mag.*, 1884) was that the result was due to an aerial bombardment from the hot wire which drove the particles away, and they tried the effect of electrifying the hot body to see if there was any modification of the dark space. A new phenomenon was discovered, the whole of the dust being driven to the sides of the containing vessel. This experiment was shown by the author at the British Association meeting in Montreal in 1884, and subsequently, on a larger scale, at the Royal Institution. In the latter experiment two pieces of wire gauze, connected to the terminals of an electric machine, were placed opposite each other in a smoke-filled chamber, through which a current of smoke was slowly passing. Upon electrifying the plates, the smoke ceased passing, the dust particles cohered, hovered in the air, and were either driven to the sides of the chamber or fell to the bottom. In the case of mist, electrification of steam in a bell jar converted it into fine rain. It seems, therefore, possible that rain might be produced by the electrification of a cloud. Sir Oliver Lodge has tried at Liverpool to disperse fogs by discharging electricity into them. For this purpose a large mast was erected on the roof of the University College buildings. It terminated in a bundle of points, to which electricity was conveyed from a Wimshurst machine by a wire supported by specially constructed insulators. In order to drive electricity from a point far removed from a surface, a high potential is necessary, and sometimes a large gas flame was used to supplement the points. Upon one occasion the discharge of electricity from the flame was sufficient to keep a clear space of 50 or 60 yards' radius in a dense fog. The author had hoped to induce the Mersey Dock Board to try the principle on a large scale, having a series of positive discharges on one side of the river and a series of negative discharges on the other, but he felt a certain reluctance in recommending the method to practical men so long as it was necessary to derive the current from a Wimshurst machine. A dynamo would be a more suitable generator if it were possible to get a sufficiently high potential. The way out of the difficulty is to rectify a high-tension alternating current, and Sir Oliver Lodge has for some time been considering the possibility of doing this by utilising Cooper-Hewitt mercury lamps. A study of these lamps has led him to believe that their rectifying power is much assisted by the outside metallic coating which surrounds the mercury electrode, and which is connected to the positive terminal of the lamp. In order to rectify an alternating discharge, four lamps are so arranged in the form of a quadrilateral that, when the leads from the terminals of an alternating transformer are connected to two opposite corners, two unidirectional currents are obtained from the other corners. Experiments have been made at Birmingham by sending the current from a high-frequency alternator (3,000 ~ per second) through the primary of an induction coil, and connecting the terminals of the secondary to the rectifiers. The length of the rectified spark can be increased by putting a number of lamps in series in each arm of the quadrilateral arrangement. Sir Oliver Lodge performed an experiment at the meeting to show the dissipation of fog by electrification. The current from an alternator was passed through the primary of a coil, and the terminals of the secondary connected to the rectifiers, 12 lamps in all, three in series in each arm. This arrangement is capable of giving a rectified spark 2 or 3 in. long, the unidirectional nature of which can be proved by passing it through a Crookes or a Röntgen tube. Some magnesium wire having been burnt under a large bell jar, to fill it with a cloud of magnesium oxide, the jar was then illuminated by the light from an electric lamp. Passing through the base-piece upon which the bell jar was placed was a conductor which terminated in a point inside the jar. When the terminals between which the rectified discharge was passing were separated, and the other end of this conductor was joined to one of them, the electricity streaming from the point into the clouded atmosphere caused an immediate deposition of the magnesium oxide.

Prof. W. E. Ayrton congratulated the author, and expressed his interest in the experiment showing the deposition of magnesium oxide. He pointed out that the combination of four Nodon valves for obtaining a continuous current from an alternating one had been used before. Dealing with the rectifier itself, he said his feeling was that the rectification was due to a difference in the electrodes and not to any special proximity of two electrodes through the glass as suggested by Sir Oliver Lodge. There were many cases of rectification—a metal-carbon arc for instance. In this case the explanation of the phenomenon was probably connected with the fact that one electrode was metallic and the other carbon. In the mercury lamp both electrodes were metallic, but the metals were very different from each other. Prof. Ayrton said that Prof. Steinmetz had recently shown him some interesting experiments with mercury arc lamps, resembling in some details the Cooper-Hewitt lamp. There was, however, no choking coil, the starting being effected by an electro-magnet capable of separating two tags within the tube, and causing a small arc which started the lamp. There was also no branch lead from the positive electrode to the mercury end of the lamp. In his opinion this connection was only a starting device in the Cooper-Hewitt lamp. Prof. Ayrton concluded by expressing his pleasure that the administrative duties of Sir Oliver Lodge had not interfered with his keen interest in scientific research.

Prof. H. L. Callendar expressed his interest in the paper and in the experiments shown. In connection with the rectification, he pointed out that under certain conditions any vacuum tube would act as a rectifier, illustrating the point by an experiment with an X ray tube. The phenomenon was noticed by Hittorf 30 years ago, and attributed by him to the constriction around the negative electrode.

Mr. W. Duddell said he should like to discuss the rectifying power

of mercury lamps. Any two different electrodes in air will rectify to some extent. In the case of two carbons, the diameters of which are as two to one, the resistance between them varies by 5 or 6 per cent., according as the current is passed one way or the other. With a metal-carbon arc it is possible to stop the current altogether. A point and plate will also act as a rectifier. He thought that the condenser arrangement was to facilitate starting, and expressed the opinion that the rectification was due to the temperature of the electrodes and the temperature gradients near them. The temperatures of the mercury and iron in a mercury lamp were very different, and in the case of a point and plane there was a difference of temperature because of the cooling of the plane by radiation. He had also found that the best rectification takes place between electrodes having a high potential difference, and that when using the lamp for practical purposes the presence of impurities improved it by facilitating starting.

Dr. C. CHREE pointed out that there was a potential gradient in the atmosphere from the ground upwards which sometimes amounted to 1,000 volts per metre and was often 150 volts per metre. He asked if this difference of potential between the ground and the tops of high trees would have any effect upon the dissipation of fog.

Sir OLIVER LODGE, replying to Dr. Chree, said it had occurred to him that atmospheric electricity must be taken into account. It was quite feasible that point discharges from trees might have some effect upon fogs, but not enough. Replying to Mr. Duddell, he said they had found that for high tension rectification it was necessary to have as good a vacuum as possible, but for lamps working on low voltages it was beneficial to permit a residue of impurities. He said he was still of the opinion that the outside connection assisted the rectification in some tubes by throwing a great strain on the gas near the cathode.

Sir OLIVER LODGE then described "An Arrangement for Driving Mercury Pumps," designed by himself and Mr. B. Davies. The apparatus was constructed because the work necessary to make large numbers of vacuum tubes renders it essential to drive the pump hydraulically. The preliminary exhaustion is effected with an ordinary Fleuss pump and the work completed by using a Töpler mercury pump. The reservoir of the pump is suspended from the rim of a 6-in. wheel, and is almost counterbalanced by a water vessel suspended from the rim of a 2-ft. wheel fixed upon the same axle. The water vessel is capable of moving up and down between vertical guides, and mechanism is so arranged that when it reaches the top of the guides a tap is turned and it is filled with water. The increase in weight causes it to descend and raises the pump reservoir. When it reaches the bottom of the guides a valve in the bottom of the vessel is opened automatically and the water is discharged. The vessel then rises again and the process is repeated. Keyed to the axle carrying the two wheels referred to, there is a third wheel, 1 ft. in diameter, over the rim of which passes a friction band. The function of this arrangement is to control the upward and downward motion of the water vessel, bringing it to rest quietly at each end of the journey and yet allowing it to move quickly. There is also a device at the bottom of the guides for keeping the valve of the vessel open until the whole of the water has been discharged. The mercury which overflows from the pump is conducted back to the reservoir, thus giving a circulation of mercury and automatically replenishing the reservoir.

NEW PATENTS APPLIED FOR, 1903.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

24,244. "An improved method of supporting trolley wires on electric tramways, railways, canals, and the electric operation of road vehicles." P. S. SHEARDOWN. November 9th.

24,248. "Improvements in and connected with collectors of electricity for railways and tramways." R. CUMMING. November 9th.

24,282. "Improvements in electric switches." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 9th.

24,283. "An improved electric switch with indicator." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 9th.

24,284. "Improvements in third-rail insulators for electric railways." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 9th.

24,285. "Improvements in electric switches." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 9th.

24,286. "Improvements in a double-throw electric switch with indicator." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 9th.

24,302. "Improvements in magneto-electric induction apparatus." A. G. BLOXAM. (A. Schoeller, Germany.) November 9th. (Complete.)

24,305. "Improvements relating to the electrical deposition of smoke, fume, mist, fog, and the like." O. J. LODGE. November 9th.

24,310. "Improvements in magnetic inductors." THE AKTIEN GESELLSCHAFT "MAGNETA." (Electrische Uhren ohne Batterie and ohne Cantacte.) November 9th. (Date applied for under Patents Act, 1901, January 20th, 1903, being date of application in Switzerland.) (Complete.)

24,333. "Sparking plug or device for electrical ignition of oil engines, gas engines, and the like." M. COOPER. November 10th.

24,343. "Improvements in or connected with telegraph perforators and typewriters." W. WAINWRIGHT. November 10th.

24,413. "Improvements relating to electric current meters." E. J. PIPER. November 10th.

24,445. "Improvements in electricity meters." G. HOOKHAM. November 11th.

24,444. "An improvement in ships' telegraphs." G. GREEN and F. E. PRIOR. November 10th.

24,449. "An improved sparking plug or electrical ignition device." G. F. H. SATOW. November 11th.

24,465. "Positive electrode for a galvanic battery." G. H. C. KOLOSCHE. November 11th.

24,469. "A new or improved suspending chain for electric lamps and the like." J. HINKS & SON, LTD., and A. H. WRIGHT. November 11th.

24,472. "Improvements in electric furnaces." E. RUHSTRAT and W. GRIMMER. November 11th. (Complete.)

24,474. "Improved apparatus for automatically controlling the speed of Wheatstone telegraphic transmitters and the like." J. GELL. November 11th.

24,488. "An improved electrical switch." E. LIDDLE and G. E. DRUIFF. November 11th.

24,500. "Transmitting alternating current through a vapor." E. WEINTRAUB. (Date applied for under Patents Act, 1901, March 23rd, 1903, being date of application in United States.) November 11th.

24,501. "Rectifying alternating current." E. WEINTRAUB. (Date applied for under Patents Act, 1901, March 23rd, 1903, being date of application in United States.) November 11th.

24,515. "Improvements in and relating to automatic transmitting apparatus for telegraphic and analogous porposes." J. T. ARMSTRONG and A. ORLING. November 11th.

24,516. "Improvements in and relating to receiving or detecting and recording apparatus for telegraphic and other electrical purposes." J. T. ARMSTRONG and A. ORLING. November 11th.

24,621. "An improved automatic guide for engaging trolley heads of electric cars with overhead wires." J. E. HOPTHROW, Sen., and J. E. HOPTHROW, Jun. November 12th.

24,626. "Improvements in or relating to plates for secondary batteries." W. P. THOMPSON. (Pflueger Accumulatoren-Werke Actiengesellschaft.) November 13th.

24,680. "Improvements in current collecting devices for electric railway vehicles." J. SHAW. November 12th.

24,680. "An electrograph or apparatus for the electrical transmission, reception, recording and reproduction of sound." E. G. CRAVEN. November 13th.

24,693. "Improvements in telephone apparatus." J. CERPAUX. November 13th.

24,695. "Improvements in or connected with means for electrically igniting miners' safety lamps." J. C. BEST. November 13th.

24,701. "Improvements in and relating to electric motion in conjunction with the creation and multiplication of electricity applicable to machinery of all kinds requiring power." T. J. HOWELL. November 13th.

24,706. "Improvements in rails for electric trams, railways and for other similar suitable purposes." T. L. PATCHETT and W. BUCK. November 13th.

24,730. "Improvements in dynamo-electric machines." J. H. ST. HILL MAWDSLEY. November 13th.

24,770. "Improvements in and relating to devices for making electrical contact in cables, armatures, and other electrical appliances." H. M. BREMNER. November 14th.

24,791. "Improved means for synchronising dynamo-electric machines." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 14th.

24,792. "Improvements in electric cut-outs." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 14th.

24,794. "Improvements in arc-extinguishing devices." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co, United States.) November 14th.

24,795. "Improvements in electric cut-outs or fuses." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 14th.

24,797. "Improvements in dynamo-electric machines." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 14th.

24,798. "Improvements in electrically-driven vehicles." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 14th.

24,799. "Improvements in electric motor systems." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) November 14th.

24,806. "Process for the electrolytic manufacture of peroxides of magnesium and zinc." F. HINZ. November 14th.

PUBLISHED SPECIFICATIONS.

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1903.

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ELECTRICITY METERS. H. Aron. 14,979. July 6th.

ELECTRICITY METERS. H. Aron. 14,980. July 6th.

KEYBOARD TELEGRAPHIC TRANSMITTERS. M. Kotyra. 15,065. July 7th.

ELECTRICAL SWITCHES. C. M. Dorman and R. A. Smith. 15,266. July 10th.

REGULATING SYSTEMS OF ELECTRIC DISTRIBUTION. P. M. Justice. (The National Battery Co., United States.) 15,479. July 13th.

REGULATING SYSTEMS OF ELECTRIC DISTRIBUTION. P. M. Justice. (The National Battery Co., United States.) 15,480. July 13th.

ARMATURES FOR ELECTRIC INDUCTION MOTORS. W. P. Thompson. (Electricitäts Gesellschaft Alioth, Switzerland.) 15,506. July 13th.

DYNAMO SUSPENSION GEAR FOR USE IN CONNECTION WITH ELECTRIC LIGHTING SYSTEMS FOR RAILWAY CARRIAGES. The Electric and Ordnance Accessories Co., Ltd., and R. A. Hall. 15,532. July 14th.

DEVICES FOR TRANSMITTING AND RECEIVING MESSAGES BY WIRELESS TELEGRAPHY. C. G. Burke. 15,552. July 14th.

METHOD OF AND APPARATUS FOR WIRELESS SIGNALLING, CHIEFLY DESIGNED FOR DETERMINING THE NAUTICAL BEARING OF NAVIGABLE VESSELS. H. W. Ladd. 15,569. July 14th.

MEANS FOR PROTECTING THE EXPOSED OR LIVE PARTS OF ELECTRIC SWITCHES CUT-OUTS OR THE LIKE. W. McDevitt. 15,623. July 14th.

ELECTRICAL FUSIBLE CUT-OUTS. C. M. Dorman, R. A. Smith and H. G. Baggs. 15,810. July 17th.

APPARATUS FOR HANDLING AND COOLING TRACK WELDING TRANSFORMERS AND WELDERS. H. F. A. Kleinschmidt. 15,884. July 17th.

RECTIFYING POLYPHASE ALTERNATING CURRENTS BY MEANS OF UNIPOLAR OR ALUMINIUM CELLS. W. E. Evans. (Allgemeine Elektricitäts Gesellschaft, Germany.) 16,132. July 21st.

INCANDESCENCE ELECTRIC LAMPS. H. Hogge and J. Barrolier. (Date applied for under Patents Act, 1901, April 8th, 1903, being date of application in France.) 16,456. July 27th.

FIELD MAGNET FOR ELECTRICAL MACHINES. T. A. Hearson. (Electricitäts Gesellschaft Alioth, Switzerland.) 16,809. July 27th.

ELECTRICAL MEANS FOR OBTAINING A SUPPLY OF HOT WATER FOR DENTAL AND OTHER PURPOSES. M. H. Schoenberg and J. W. Edwards. 16,661. July 29th.

HOLDING DEVICES FOR THE COLLECTING BRUSHES OF ELECTRICAL MACHINES. C. Breger. (Electricitäts Gesellschaft Alioth, Switzerland.) 16,808. July 31st.

CLAMPS FOR WIRES ESPECIALLY APPLICABLE FOR USE IN OVERHEAD ELECTRIC CONDUCTORS. F. Kruckl. 17,184. August 7th.

JUNCTION OR INSPECTION BOXES AND LIKE INSPECTION FITTINGS USED WITH ELECTRIC WIRING. E. White and J. Waldron. 17,564. August 13th.

CONNECTION BLOCK FOR ELECTRIC CONDUCTORS APPLICABLE ALSO AS AN INSERTION CONTACT AND CEILING ROSETTE. W. P. Thompson. (The firm of C. & E. Keller, Germany.) 18,376. August 25th.